# Scheme of Teaching and Evaluation for B.E
## III & IV Semester
# Artificial Intelligence & Machine Learning
## (2022 Scheme)

B.E. in Artificial Intelligence & Machine Learning Scheme of Teaching and Examinations - 2022

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

**(Effective from the academic year 2023-24)**

## III SEMESTER

| SN | Course | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22MDAI31 | Graph theory and Discreet Mathematical Structures | TD: Maths, PSB: Maths | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22AI32 | Digital System Design and Computer Organization | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22AI33 | Operating System | TD & PSB: CSE /AIML /CS[AI],CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22AI34 | Data Structures and Applications | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22AIL35 | Data Structures Lab | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22AI36 | ESC/ETC/PLC Object Oriented Programming With JAVA | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22SC37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC/ SEC | 22AI38X | Ability Enhancement Course / Skill Enhancement Course - III | TD & PSB: CSE /AIML / CS[AI],CS[DS] | If the course is a Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If the course is a Laboratory | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| Total | | | | | | | | | | 550 | 350 | 900 | 20 |

| Ability Enhancement Course – III | | | |
|---|---|---|---|
| **22AI381** | **Unix and Shell Programming** | **22AI382** | **Version Controller with GiT** |
| **22AI383** | **R Programming** | | |

# IV SEMESTER

| SN | Course and Course Code | | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self-Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22BB41 | Biology for Engineers | TD & PSB: | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22AI42 | Principles of Artificial Intelligence | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22AI43 | Database Management Systems | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22AI44 | Analysis and Design of Algorithms | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22AIL45 | Algorithms Lab | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22AI46X | ESC/ETC/PLC | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | AEC/ SEC | 22PSW47 | Professional Skills for the Work Place | TD & PSB: H & S | If the course is a Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If the course is a Laboratory | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 8 | UHV | 22UH48 | Universal human values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | 22NS49 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE49 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Yoga | Yoga Teacher | | | | | | | | | |
| Total | | | | | | | | | | 500 | 400 | 900 | 20 |

| Engineering Science Course (ESC/ETC/PLC) | | | |
|---|---|---|---|
| **22AI461** | **System Software** | **22AI462** | **Object Oriented Programming with Python** |
| **22AI463** | **Introduction to Data Analytics** | | |

**Semester: III**
**Course Name: Graph theory and Discrete Mathematical Structures**

| | | | |
|---|---|---|---|
| Course Code | **22MDAS31** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
1. Definition of a set, operations on sets and definitions of different types of functions.
2. First order Ordinary Differential Equations.

**Course objectives:**
1. Students will achieve command of the fundamental definitions and concepts of graph theory.
2. Be able to formulate and prove central theorems about trees, connectivity, coloring, and planar graphs.
3. Be able to describe and apply some basic algorithms for graphs;
4. Understand an intense foundational introduction to fundamental concepts in discrete mathematics.
5. Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.

**Module – 1 Introduction to Graph Theory** **08 Hours**

Definition of degree, graph, incidence, Sub graphs, connected graphs, complete graph, Complement of a graph, and Graph Homorphism and Isomorphism. Bipartite graphs, Walks, cycles and paths, Hamiltonian and Euler Circuits. Planar graphs, Euler's formula with proof, Dual of a planar graph.
**Self-Study:** The Konigsberg bridge problem.
**Applications:** Internet field. Google maps, webpage searching.

**Module – 2 Trees** **08 Hours**

Definitions of a tree, Properties of trees, connected trees, Minimally connected graphs. Theorems on Trees (with proof) such as "A tree with n vertices has (n-1) edges". "Any connected graph with n vertices and (n-1) edges is a tree". "A connected graph is a tree if and only if it is minimally connected" and Examples, Routed trees, Weighted Trees and Prefix Codes.
**Self-Study:** Sorting technique.
**Applications:** Representing hierarchical data, and providing efficient algorithms for operations such as insertion, deletion, and searching.

**Module – 3 Spanning trees and Algorithms:** **08 Hours**

Definition of a spanning tree. Minimal Spanning Trees – Kruskal's and Prim's algorithms, cut sets and capacity of cuts.
Transport Networks – Max-flow, Min-cut Theorem (without proof).Problems.
**Self-Study:** Matching theory. Dijkstra's algorithm Shortest Path.
**Applications:** Sorting, processing and machine learning.

**Module – 4 Relations and Functions** **08 Hours**

Definition of a relation, Matrix of a relation, Diagraph of a relation. Properties of relation. Equivalence relation (Theorems on Equivalence Relations). Partial ordered relation and poset. Least upper bound and greatest lower bound, Hasse diagram.
Compositions of functions (Theorems on Composition functions), The pigeon hole principle. Permutation functions.
**Self-Study:** Invertible functions.
**Applications:** Writing a computer programme and coding.

**Module – 5 Recurrence Relations** **08 Hours**

Definition of a recurrence relation, First Order Linear Recurrence Relation, applications of linear recurrence relations. The Second Order Linear Homogeneous Recurrence Relation, Non-homogeneous Recurrence Relation.
Self-Study: Generating Functions.
Applications: To express the runtime complexity of an algorithm in a concise and mathematical form.

**Course Outcomes:**

CO 1: Apply the basic concepts of graph theory and judge the planar graphs.
CO 2: Analyze the significance of graph theory in different engineering disciplines
CO 3: Apply algorithms used in interdisciplinary engineering domains.
CO 4: Analyze the concepts of relations to various fields of Engineering.
CO 5: Apply the concepts of functions and recurrence relations in the context of various fields of Computer Science & Engineering, like, finite Automata and formal languages, Compilers etc.

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Graph Theory: With Application to Engineering and Computer Science", | Narsingh Deo, | Prentice Hall of India, | 16th Edition.2003. |
| 2 | "Graph Theory Applications" | L.R.Foulds , | Springer | 10th Edn.2016 |
| 3 | Foundation of Discrete Mathematics | K D Joshi | ***New*** Age Publishers, Ltd | 10th Edition, 2014 |
| 4 | Discrete and Combinatorial Mathematics | Ralph P. Grimaldi | Pearson Education.Inc. | 5th Edition, 2011. |
| **Reference Books** | | | | |
| 1 | Discrete Mathematical structures and Graph theory | Dr D.S.Chandrasekharaiah. | Prism Books Pvt Ltd | 6th Edition, 2019. |
| 2 | Discrete Mathematics and its applications | Kenneth H. Rosen | Tata Mcgraw-Hill, | 7th Edition,2012 |
| 3.. | Discrete Mathematical Structures: Theory and Applications | D. S. Malik, M. K. Sen | Thomson Course Technology. | 1st Edition, 2004. |
| 4. | "Discrete Mathematics and Its Applications", | Kenneth H. Rosen, | McGraw Hill | 6th Edition, 2007. |

e-Resources:
http://nptel.ac.in/courses/111106050/13.
https://www.youtube.com/watch?v=5TgonnFaDkA.
https://www.youtube.com/watch?v=u71Up-m5NBQ.
https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11.
https://www.youtube.com/watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index= 13.
https://www.youtube.com/watch?v=7cTWea9YAJE&list=PL0862D1A947252D20&index=24.
https://www.youtube.com/watch?v=695iAm935cY&list=PL0862D1A947252D20&index=25.
https://www.youtube.com/watch?v=X0sGo7X2xHw.
https://www.youtube.com/watch?v=7FJ08NILBuA

**Semester: III**

**Course Name: DIGITAL SYSTEM DESIGN AND COMPUTER ORGANIZATION**

| | | | |
|---|---|---|---|
| Course Code | **22AI32** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**
1. Basic Electronics
2. Basic Structure of Computer.

**Course Objectives:**
1. Illustrate different simplifying techniques in the design of combinational circuits.
2. Design various combinational and sequential digital circuits.
3. Design various counters using Flip-Flops.
4. Demonstrate the fundamentals of computer organization with machine instructions.
5. Elaborate the communication of input/output devices with computer system and solve arithmetic Operations using various techniques.

**Module – 1** **08 Hours**

**Karnaugh Maps:** minimum forms of switching functions, two and three variable Karnaugh maps, four variable Karnaugh maps, determination of minimum expressions using essential prime implicants, Quine- McCuskey Method: determination of prime implicants, the prime implicant chart, simplification using map-entered variables

**Module - 2** **08 Hours**

**Multiplexers, Decoders and Programmable Logic Devices:** Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.
**Latches and Flip-Flops:** Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop, SR Flip Flop, J K Flip Flop, T Flip Flop.

**Module – 3** **08 Hours**

**Register and Counters:** Register and register transfers, Shift registers
**Counters:** design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops. Sequential parity checker

**Module – 4** **08 Hours**

**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes

**Module – 5** **08 Hours**

**Input/output Organization:** Accessing I/O Devices, Interrupts, Direct Memory Access, Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth algorithm.

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | a) Realize 3-Variable and 4-variable Boolean expressions, simplify it using K-map and Implement using basic gates.<br>b) Simulate and verify the working of above expressions using VHDL |
| 2 | a) Design and implement Half adder and Full Adder using basic gates.<br>b) Simulate and verify the working of Half adder and Full Adder using VHDL |
| 3 | a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer.<br>b) Simulate and verify the working of 8:1 multiplexer using VHDL |
| 4 | a) Design and implement the Binary to Gray Code converter using basic gates.<br>b) Simulate and verify the working of Binary to Gray Code converter using VHDL |
| 5 | a) Design and implement the Truth Table of a 3-bit Parity Generator and 4-bit Parity Checker with an even parity bit using basic Gates. |
| 6 | a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.<br>b) Simulate and verify the working of D Flip-Flop with positive edge triggering using VHDL. |
| 7 | a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-flop ICs<br>b) Simulate and verify the working of mod-8 up counter using VHDL. |
| 8 | a) Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC7447).<br>b) Simulate and verify the working of Switched tail counter using VHDL |

**Course Outcomes:**

1. Apply different simplifying techniques in the design of combinational circuits.
2. Design various combinational and sequential digital circuits.
3. Design various counters using Flip-Flops.
4. Describe the fundamentals of computer organization with machine instructions.
5. Elaborate the communication of input/output devices with computer system and solve arithmetic Operations using various techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Analog and Digital Electronics | Charles H Roth and Larry L Kinney | Cengage Learning | 2019 |
| 2 | Computer Organization | Carl Hamacher, Zvonko Vranesic, Safwat Zaky | Tata McGraw Hill | 5th Edition 2002 |
| **Reference Books** | | | | |
| 1 | Digital Principles and Applications, | Donald P Leach, Albert Paul Malvino & Goutam Saha | Tata McGraw Hill, | 8th Edition 2015 |
| 2 | Computer Organization & Architecture, Pearson | William Stallings | | 9th Edition |

e-Resources: **http://lms.vtu.ac.in/econtent/CSE.php**

**Semester: III**
**Course Name: OPERATING SYSTEM**

| | | | |
|---|---|---|---|
| Course Code | **22AI33** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Exam Hours | **3** |
| Credits | **4** | Total Marks | **100** |

**Pre-requisites:** The students should have the knowledge of:
1. Basics of computer system and its applications
2. Basics of computer programming

**Course objectives:**
1. To introduce operating system, OS responsibilities, and OS services.
2. To discuss process concept, process scheduling techniques, and multi-threading concepts.
3. To demonstrate deadlock condition in the computer system, and usage of main memory.
4. To introduce virtual memory management concepts and file system.
5. To explain about secondary storage system and Linux OS as a case study.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems;
**Operating System Services:** User - Operating system interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating system structure; Virtual machines; System boot.

**Module - 2** **08 Hours**

**Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication.
**Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; thread scheduling.
**Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; threading issues.

**Module – 3** **08 Hours**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.
**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

**Module – 4** **08 Hours**

**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.
**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Module – 5** **08 Hours**

**Secondary Storage Structures, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management.
**Case Study:** The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Install an operating system on a physical or logical (virtual) machine. |
| 2 | Design, develop and implement program to simulate the working of Shortest Remaining Time First scheduling algorithm. Experiment with different length jobs. |
| 3 | Design, develop and implement program to simulate the working of Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm. |
| 4 | Design, develop and implement a Banker's algorithm. Assume suitable input required to demonstrate the results. |
| 5 | Design, develop and implement page replacement using FIFO algorithms. Assume suitable input required to demonstrate the results. |
| 6 | Design, develop and implement page replacement using LRU algorithms. Assume suitable input required to demonstrate the results. |
| 7 | Design, develop and implement optimal page replacement algorithms. Assume suitable input required to demonstrate the results. |

**Course Outcomes:** At the end of the course students will be able to
1. Analyze the need, responsibilities, and services of OS.
2. Compare different process scheduling techniques.
3. Examine deadlock situation, prevention, avoidance and recovery.
4. Implement virtual memory management concept and file system.
5. Demonstrate the structure of secondary storage and design of Linux OS.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition,, 2006 |
| Reference Books | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed,, 2013. |
| 2 | An Introduction to Operating Systems: Concepts and Practice | P.C.P. Bhatt | PHI(EEE) | 4th Edition, 2014 |

**E-Resources:**
https://www.operating-system.org/
https://blog.feedspot.com/operating_system_blogs/
https://www.youtube.com/playlist?list=PLhqPDa2HoaAZLws7PFYWl4MnzCyHf8do-
https://medium.com/javarevisited/6-best-operating-system-courses-for-beginners-to-learn-7d727882d267

**Semester: III**
**Course Name: DATA STRUCTURES AND APPLICATIONS**

| | | | |
|---|---|---|---|
| Course Code | **22AI34** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **03** |

**Course objectives:**
1. Explain the fundamentals of data structures and their applications to solve real life problems.
2. Demonstrate the working of linear and nonlinear data structures.
3. Write solutions to problems using linear data structures and nonlinear data structures.
4. Apply different data structures to solve given problem.
5. Develop skills to apply appropriate data structures in problem solving.

**Module – 1** **08 Hours**

**Review of C Language:** Arrays, Structures & Unions, Pointers and Dynamic memory allocation
**Introduction to Data Structures:** Classifications of Data Structures, Data structure operations: Traversing, inserting, deleting, searching and sorting.
**Applications:** Representation of Polynomials and Sparse Matrices

**Module - 2** **08 Hours**

**Stacks:** Stack Operations, Array Representation of Stacks, Different types of expression: Infix, Postfix and Prefix.
**Stack Applications:** Infix to postfix conversion, Infix to prefix conversion, Evaluation of postfix expression, Recursion.
**Queues:** Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues.

**Module – 3** **08 Hours**

**Linked Lists:** Classification of linked lists. Representation of different types of linked lists in Memory. Traversing, Insertion, Deletion, Searching, Sorting and Concatenation Operations on Singly linked list. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues.
**Applications of Linked lists** – Polynomials, Sparse matrix representation.

**Module – 4** **08 Hours**

**Trees 1:** Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder;
**Threaded binary trees**
**Binary Search Trees:** Binary Search Trees, Insertion, Deletion, Traversal and Searching operations on Binary search tree. Application of Trees: - Evaluation of Expression.

**Module – 5** **08 Hours**

**Graphs:** Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
**Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

**Course Outcomes:**

1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | $2^{nd}$Ed, 2014 |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | $2^{nd}$Ed, 2014 |
| **Reference Books** | | | | |
| 1 | Data Structures using C | ReemaThareja | Oxford press | $3^{rd}$Ed 2012 |
| 2 | Data Structures using C | A M Tenenbaum | PHI | 2001 |

**Semester: III**

**Course Name: DATA STRUCTURES AND APPLICATIONS LAB**

| | | | |
|---|---|---|---|
| Course Code | **22AIL35** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **03** |

**<u>List of Experiments:</u>**

**Course Objectives:**

1. Illustrate implementation of basic operations on data structures.
2. Interpret Applications of different data structures.
3. Demonstrate data structures and their variants.
4. Illustrate various searching techniques using trees and graphs.
5. Develop skills to identify appropriate data structures to solve a given problem.

**Identify the functional requirements, then Design and Develop solutions to the problems related to the data structures**

1. Stacks and Queues
2. Linked list
3. Trees
4. Graphs
5. Hashing techniques

**Course outcomes:**

1. Design programs to implement basic operations on data structures.
2. Apply different data structures to solve problems.
3. Develop programs to demonstrate variants of queues and linked list
4. Implement various Searching techniques using trees and graphs.
5. Choose appropriate data structures to solve a given problem.

**Semester: III**

**Course Name: OBJECT ORIENTED PROGRAMMING WITH JAVA**

| | | | |
|---|---|---|---|
| Course Code | **22AI36** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **3** |

**Pre-requisites:**

Students should know the basic knowledge on:

- C Programming
- C++

**Course objectives:**

1. Learn fundamental features of object-oriented language and JAVA.
2. Learn object-oriented concepts using programming examples.
3. Study the concepts of importing packages, exception handling mechanism and multithreading.
4. Introduce event handling mechanism.
5. Create Graphical User Interface (GUI) applications using swings.

**Module – 1** **08 Hours**

**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.
**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses.
**Control Statements:** Java's Selection Statements, Iteration Statements

**Module - 2** **08 Hours**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, "This" Keyword, Garbage Collection.
**A Closer Look at Methods and Classes:** Overloading Methods.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

**Module – 3** **08 Hours**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces.
**Exception Handling:** Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.
**Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(),Thread Priorities.

**Module – 4** **08 Hours**

**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model; Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes.

**Module – 5** **08 Hours**

**Introducing Swings:** The Origins of Swing, Two Key Swing Features, Components and Containers, The Swing Packages; A Simple Swing Application, Create a Swing Applet.
**Exploring Swings:** Jlabel and Image Icon, J Text Field, The Swing Buttons, J Tabbed pane, JList, JCombo Box, J Table.

**Course Outcomes:**
1. Identify classes, objects, members of a class and relationship among them needed for a specific problem.
2. Implement reusability Programs in JAVA using inheritance.
3. Develop JAVA Programs of error handling techniques using exception handling.
4. Apply the concepts of event handling to develop GUI programs.
5. Apply the concepts of Java Swings to develop robust programs.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8thEdition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balagurusamy | Tata McGraw Hill | 3rd Edition,2007 |

e-Resources:
Howtoinstalljava:-*https://youtu.be/IJ-PJbvJBGs*
JavaSwings:-*https://youtu.be/TwMXA1S38qg*
JavaQuiz:-https://www.w3schools.com/java/java_quiz.asp
JavaConcepts:-https://www.javatpoint.com/java-tutorial
ProgrammingExercises:-https://www.programiz.com/java-programming/examples

**Semester: III**
**SOCIAL CONNECT & RESPONSIBILITY**

| | | | |
|---|---|---|---|
| Course Code | **22SC37** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P: S) | **0:0:2** | SEE Marks | **--** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (No SEE – Only CIE) | **For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept. / Any Dept.** | | |
| Credits | **01 – Credit** | | |

**Course objectives:**
The course will enable the students to:
1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Contents:**
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

**In the following a set of activities planned for the course have been listed:**

| **Contents** |
|---|
| **Part I:**<br>**Plantation and adoption of a tree:**<br>Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. |
| **Part II :**<br>**Heritage walk and crafts corner:**<br>Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes. |
| **Part III :**<br>**Organic farming and waste management:**<br>Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – |
| **Objectives, Visit, Case Study, Report, Outcomes.** |

**Part IV:**
**Water conservation:**
Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

**Part V :**
**Food walk:**
City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Communicate and connect to the surrounding.
CO2: Create a responsible connection with the society.
CO3: Involve in the community in general in which they work.
CO4: Notice the needs and problems of the community and involve them in problem –solving.
CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Activities:**
Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**PEDAGOGY:**
The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs / social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

**COURSE TOPICS:**
The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

**DURATION:**
A total of 40 - 50 hours engagement per semester is required for the 3rd semester of the B.E. / B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

**Guideline for Assessment Process:**

**Continuous Internal Evaluation (CIE):**

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor / s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and / or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

**Excellent: 80 to 100**
**Good: 60 to 79**
**Satisfactory: 40 to 59 Unsatisfactory and fail : <39**

**Special Note:**

**NO SEE – Semester End Exam – Completely Practical and activities based evaluation**

**Pedagogy – Guidelines:**

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

| SN | Topic | Group size | Location | Activity Execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Plantation and adoption of a tree: | May be individual or team | Farmers land / parks / Villages / roadside / community area / College campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 2. | Heritage walk and crafts corner: | May be individual or team | Temples / monumental places / Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 3. | Organic farming and waste management: | May be individual or team | Farmers land / parks / Villages visits / roadside / community area / College campus etc. | Group Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 4. | Water conservation: & conservation techniques | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 5. | Food walk: Practices in society | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Group Selection / Proper Consultation A/ Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |

**Plan of Action (Execution of Activities)**

| SN | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study based Assessment, Individual performance |
| 9 | Sector / Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities, compiled report should be submitted as per the instructions and scheme.

**Semester: III**
**Course Name: UNIX AND SHELL PROGRAMMING**

| | | | |
|---|---|---|---|
| Course Code | **22AI381** | CIE Marks | **50** |
| Teaching Hours/Week (L: T :P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
Knowledge of DOS and Windows

**Module – 1** **03 Hours**

Introduction, Brief history, Unix Architecture, Features of Unix, locating commands, Command structure, Internal and External commands, man command, Understanding the man documentation, Basic commands such as cal, date, echo, printf, passwd, who, wc, ls.

**Module - 2** **03 Hours**

**Unix files:** Basic file types, Parent-child relationship, the home directory, PATH variable. Relative and absolute pathnames.
Directory commands – pwd, cd, mkdir, rmdir commands,
File related commands – cat, cp, rm, mv.

**Module – 3** **03 Hours**

**File Types & Permission:**
The ls -l command, -d options, File ownership, File permissions, chmod, Directory permissions, changing File ownership.
**The vi editor:** Different modes of vi, Input mode commands, Command mode commands, ex-mode commands, Repeat command, Pattern searching, Search and Replace command.

**Module – 4** **03 Hours**

The shells interpretive cycle: Wild cards, Escaping and Quoting, Three standard files and redirection, Pipe, tee, Command substitution.
Shell programming: Ordinary and environment variables, read command, Command line arguments, exit and exit status of a command, Logical operators for conditional execution, test command and its shortcut, if, expr, while, for, and case-control statements, set and shift commands, positional parameters.

**Module – 5** **03 Hours**

Process: Basics, Mechanism of process creation, Parent and child process, The ps command with its options, Signals, Job control.
File Links: Hard link and soft link, umask, head, tail, cut, paste, sort and grep commands.

**Course Outcomes:**

1. Demonstrate the architecture and salient features of UNIX OS.
2. Understand UNIX Commands, Shell basic, and shell environments.
3. Create a file with vi editor and Apply changes in the file permission and ownership.
4. Design and develop shell programs using loops, and control statements.
5. Create UNIX Processes and a simple filter.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Unix Concepts and Applications | Sumitabha Das | Tata McGraw Hill | $4^{th}$ Edition |

**Semester: III**
**Course Name: Version Controller with GiT**

| | | | |
|---|---|---|---|
| Course Code | **22AI382** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
- Basic knowledge of computer hardware and software
- Basic knowledge of programming

**Course objectives:**
1. To demonstrate the installation Git, set up their initial configuration, and comprehend the advantages and disadvantages of using Git for version control.
2. To illustrate the concept of creating and managing Git repositories
3. To implement branching concepts of Git including creating, merging, and switching branches, enabling them to effectively manage parallel development efforts
4. To illustrate setting up Git on a server, allowing them to facilitate collaborative development
5. To experiment with hosting repositories on GitHub, managing project issues there, and collaborating with others.

**Module – 1** **03 Hours**

**Getting Started:** Version Control Basics, What Is Git?, Advantages Of Git, Disadvantages Of Git. The Basics: Installing Git, First Time Git Set Up, Tips And Troubleshooting

**Module - 2** **03 Hours**

**Working with Repositories:** What Are Git Repositories?, Recording Changes To Repos, Working With Remotes, Git Aliases, Tagging

**Module – 3** **03 Hours**

**Working with Branches:** What Are Branches?, Branching And Merging, Branch Workflows, Remote Branches

**Module – 4** **03 Hours**

**Working with Servers:** Getting Git On Server, Server Setup, Distributed Git And Projects

**Module – 5** **03 Hours**

**GitHub:** What Is Github?, History Of Github, How To Use Github, Different Types Of Accounts

**Course Outcomes:**
1. Install Git, set up their initial configuration, and comprehend the advantages and disadvantages of using Git for version control.
2. Gain proficiency in creating and managing Git repositories
3. Implement branching concepts of Git including creating, merging, and switching branches, enabling them to effectively manage parallel development efforts
4. Set up Git on a server, allowing them to facilitate collaborative development
5. Use GitHub as a platform for hosting repositories, tracking project issues, and collaborating with others

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Git: A Beginner's Guide | Sumanna Kaul, Shahryar Raz, and Divya Sachdeva | CRC Press | 2022 |
| **Reference Books** | | | | |
| 1 | Learning Git | Anna Skoulikari | O'Reilly Media | 2023 |
| 2 | Git Repository Management in 30 Days: Learn to manage code repositories like a pro | Sumit Jaiswal | BPB Publications | 2023 |
| 3 | Pro Git | Scoot Chacon | Apress | 2023 |
| | | | | |

e-Resources: **https://pdfdrive.to/filedownload/mastering-git-a-beginners-guide-mastering-computer-science**

**Semester: III**
**Course Name: R Programming**

| | | | |
|---|---|---|---|
| Course Code | **22AI383** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:** Knowledge of basic computer hardware, Software and any programming language

**Course objectives:**
1. Explore and understand how R and R Studio interactive environment.
2. To learn and practice programming techniques using R programming.
3. Read Structured Data into R from various sources.
4. Understand the different data Structures, data types in R.
5. To develop small applications using R Programming.

**Module – 1** **03 Hours**

**Numeric, Arithmetic, Assignment, and Vectors:** R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

**Module - 2** **03 Hours**

**Matrices:** Defining a Matrix, Sub-setting, Matrix Operations
Conditions and Looping: if statements, looping with for, looping with while, vector based programming.

**Module – 3** **03 Hours**

**Lists and Data Frames:** Data Frames, Lists: Special values, The apply family.

**Module – 4** **03 Hours**

**Programming with Functions -1:** Functions, scope and its consequences, Arguments.

**Module – 5** **03 Hours**

**Programming with Functions-2:** Vector Based programming using functions, Recursive Programming, Debugging functions

**Course Outcomes:**
1. Apply the fundamentals of R Programming to solve basic mathematical functions.
2. Design and Develop R programs using branching and iterative statements.
3. Apply critical programming concepts to solve real life problems.
4. Demonstrate R programs using functions.
5. Develop simple applications using Vector Based Programming.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC | Jones, O., Maillardet. R. and Robinson.A | The R Series. | 2014 |
| **Reference Books** | | | | |
| 1 | Statistics: An Introduction using R | Michael J. Crawley | Wiley | Second edition, 2015 |

**e-Resources:**

Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz.
R programming for Beginners: **https://www.youtube.com/watch?v=fDRa82lxzaU**

**Semester: III**
**NATIONAL SERVICE SCHEME (NSS) - (3rd to 6th)**

| | | | |
|---|---|---|---|
| Course Code | **22NS39** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P) | **0:0:3** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (SEE) | Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th Semester) | | |
| Credits | NCMC – Non Credit Mandatory Course<br>(Completion of the course shall be mandatory for the award of degree) | | |

**Course objectives:**
National Service Scheme (NSS) will enable the students to:
1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**General Instructions - Pedagogy:**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

**National Service Scheme (NSS) – Contents:**
1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,
9. Spreading public awareness under rural outreach programs.(minimum5 programs).

10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

**NOTE:**

- Student / s in individual or in a group should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

**Semester wise from 3rd to 6th semester**
**DISTRIBUTION OF ACTIVITIES**

| Semester | Topics / Activities to be Covered |
|---|---|
| 3rd Sem. | 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.<br>2. Waste management– Public, Private and Govt organization, 5 R's.<br>3. Setting of the information imparting club for women leading to contribution in social and economic issues. |
| 4th Sem. | 4. Water conservation techniques – Role of different stakeholders– Implementation.5<br>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.<br>6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. |
| 5th Sem. | 7. Developing Sustainable Water management system for rural areas and implementation approaches.<br>8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,<br>9. Spreading public awareness under rural outreach programs.(minimum5 programs).<br>10. Social connect and responsibilities. |
| 6th Sem. | 11. Plantation and adoption of plants. Know your plants.<br>12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).<br>13. Govt. school Rejuvenation and helping them to achieve good infrastructure. |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.**

| SN | Topic | Group size | Location | Activity execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers Land / Villages / Roadside / Community Area / College Campus Etc., | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 2. | Waste management– Public, Private and Govt. organization, 5 R's. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,, | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 3. | Setting of the information imparting club for women leading to contribution in social and economic issues. | May be individual or team | Women Empowerment Groups / Consulting NGOs & Govt. Teams / College Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 4. | Water conservation techniques – Role of different stakeholders– Implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 5. | Preparing an actionable business proposal for enhancing the village income and approach for implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 6. | Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. | May be individual or team | Local Government / Private / Aided Schools / Government Schemes Officers / Etc., | School selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 7. | Developing Sustainable Water management system for rural areas and implementation approaches. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. | Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc., | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 9. | Spreading public awareness under rural outreach programs (minimum5 programs) / Social connect and responsibilities. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 10. | Plantation and adoption of plants. Know your plants. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 11. | Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs). | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 12. | Govt. school Rejuvenation and helping them to achieve good infrastructure. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government/ Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

## Plan of Action (Execution of Activities for Each Semester)

| SN | Practice Session Description |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems / issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.
CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**SUGGESTED LEARNING RESOURCES:**
**Books:**
**NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
Government of Karnataka, NSS cell, activities reports and its manual.
Government of India, NSS cell, Activities reports and its manual.

**Semester: III**

**PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I**

| | | | |
|---|---|---|---|
| Course Code | **22PE39** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional / state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

**Module I: Orientation** **05 Hours**

a. Lifestyle
b. Fitness
c. Food & Nutrition
d. Health & Wellness
e. Pre-Fitness test.

**Module II: General Fitness & Components of Fitness** **15 Hours**

a. Warming up (Free Hand exercises)
b. Strength – Push-up / Pull-ups
c. Speed – 30 Mtr Dash
d. Agility – Shuttle Run
e. Flexibility – Sit and Reach
f. Cardiovascular Endurance – Harvard step Test

**Module III: Recreational Activities** **10 Hours**

a. Postural deformities.
b. Stress management.
c. Aerobics.
d. Traditional Games.

**Semester III**
**YOGA FOR A BETTER LIFE (3rd to 6th)**

| | | | |
|---|---|---|---|
| Course Code | **22YO39** | CIE Marks | 100 / Sem. |
| Teaching Hours / Week (L:T:P) | **0:0:2** | SEE Marks | --- |
| Total Hours of Pedagogy per semester | **24 - 28 hours (Theory + practical)** | Total Marks | 100 / Sem. |
| Examination nature (SEE): | **Objective type Theory / Practical / Viva-Voce** | | |

**Course objectives:**
1. To enable the student to have good health.
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.
5. To attain higher level of consciousness.

**The Health Benefits of Yoga**
The benefits of various yoga techniques have been supposed to improve
- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

  The system has been advocated as a complementary treatment to aid the healing of several ailments such as
- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

  The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).
  If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system

- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills

- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

## Semester III
## YOGA SYLLABUS

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health

Rules to be followed during yogic practices by practitioner Yoga its misconceptions,
**Difference between yogic and non-yogic practices**
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**
a. Sitting: 1. Padmasana, 2. Vajrasana
b. Standing: 1. Vrikshana, 2. Trikonasana
c. Prone line: 1. Bhujangasana, 2. Shalabhasana
d. Supine line: 1. Utthitadvipadasana, 2. Ardhahalasana

**Semester IV**
Patanjali's Ashtanga Yoga, its need and importance.
Yama: Ahimsa, Satya, Asteya, Brahmacarya, Aparigraha
Niyama: Shoucha, Santosh, Tapa, Svaadhyaya, Eshvarapranidhan, Suryanamaskar12 Count- 4 Rounds of Practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**
a. Sitting: 1. Sukhasana, 2. Paschimottanasana
b. Standing: 1. Ardhakati Chakrasana, 2. Parshva Chakrasana
c. Prone line: 1. Dhanurasana,
d. Supine line: 1. Halasana, 2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes / min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama: 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana, 4. Chandra Bhedana 5. Nadishodhana

**Semester: III / IV**
**BIOLOGY FOR ENGINEERS**

| | | | |
|---|---|---|---|
| Course Code | **22BB31 / 41** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P: S) | **3:0:0:** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **3** |
| Examination type (SEE) | **Theory** | | |

**Course objectives:**
- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning / inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical / hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR / VR / MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical / hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) / oral presentations.

**Module-1** **08 Hours**

**INTRODUCTION TO BIOLOGY:**
The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

**Module-2** **08 Hours**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):**
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents / detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

**Module-3** **08 Hours**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):**
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

**Module-4** **08 Hours**

**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):**
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

**Module-5** **08 Hours**

**TRENDS IN BIOENGINEERING (QUALITATIVE):**
Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

**Course outcome (Course Skill Set)**
At the end of the course, the student will be able to :
1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

**Suggested Learning Resources:**
**Books**
- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.

- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

**Web links and Video Lectures (e-Resources):**
- https: / / nptel.ac.in / courses / 121106008
- https: / / freevideolectures.com / course / 4877 / nptel-biology-engineers-other-non-biologists
- https: / / ocw.mit.edu / courses / 20-020-introduction-to-biological-engineering-design-spring-2009
- https: / / ocw.mit.edu / courses / 20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https: / / www.coursera.org / courses?query=biology
- https: / / onlinecourses.nptel.ac.in / noc19_ge31 / preview
- https: / / www.classcentral.com / subject / biology
- https: / / www.futurelearn.com / courses / biology-basic-concepts

**Activity Based Learning (Suggested Activities in Class) / Practical Based learning**
- Group Discussion of Case studies
- Model Making and seminar / poster presentations
- Design of novel device / equipment like Cellulose-based water filters, Filtration system

**Semester: IV**

**Course Name: PRINCIPLES OF ARTIFICIAL INTELLIGENCE**

| | | | |
|---|---|---|---|
| Course Code | **22AI42** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Credits | **04** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |

**Pre-requisites:**

- Knowledge of a programming language and Mathematical knowledge.

**Course objectives:**

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving.
3. Get to know approaches of inference, perception, Uncertain Knowledge and Reasoning.
4. Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
5. Experiment with a machine learning model for simulation and analysis.

**Module – 1** **08 Hours**

**Introduction:** What is AI? Foundations and History of AI

**Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

**Module - 2** **08 Hours**

**Problem-solving:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

**Module – 3** **08 Hours**

**Informed Search Strategies:** Heuristic functions, Greedy best first search, A*search. Heuristic Functions

**Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic.

**Module – 4** **08 Hours**

**First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.

**Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution

**Module – 5** **08 Hours**

**Uncertain Knowledge and Reasoning:** Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited.

**List of Experiments:**

**Part A**

**Practicing Problems in Python (Students can be encouraged to practice good number of practice problems, some practice problems are listed here)**

1. (a) Write a python program to print the multiplication table for the given number
   (b) Write a python program to check whether the given number is prime or not?
   (c) Write a python program to find factorial of the given number?
2. (a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)
   (b) Write a python program to implement List methods (Add, Append, and Extend& Delete).
3. Write a python program to implement simple Chabot with minimum 10 conversations
4. Write a python program to Illustrate Different Set Operations
5. (a) Write a python program to implement a function that counts the number of times a string (s1) occurs in another string(s2)
   (b) Write a program to illustrate Dictionary operations ([], in, traversal) and methods: keys (),values(),items()

**Part B**

**AI Problems to be implemented in Python**

1. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2. Implement and Demonstrate Best First Search Algorithm on any AI problem
3. Implement AO* Search algorithm.
4. Solve 8-Queens Problem with suitable assumptions
5. Implementation of TSP using heuristic approach
6. Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining
7. Implement resolution principle on FOPL related problems
8. Implement any Game and demonstrate the Game playing strategies

**Course Outcomes:**

At the end of the course the student will be able to:
1. Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
2. Analyse Searching and Inferencing Techniques.
3. Develop knowledge base sentences using propositional logic and first order logic
4. Demonstrating agents, searching and inferencing
5. Illustrate the application of probability in uncertain reasoning

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence | Stuart J. Russell and Peter Norvig | Pearson | 3rd Edition,2015 |
| **Reference Books** | | | | |
| 1 | Introduction to Machine Learning | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3RD Edition 2013 |
| 2 | Artificial Intelligence Structure and strategies for complex | George F Lugar | Pearson Education | 5th Edition 2011 |

**Semester: IV**
**Course Name: DATABASE MANAGEMENT SYSTEMS**

| | | | |
|---|---|---|---|
| Course Code | **22AI43** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS approach, History of database applications. When Not to Use a DBMS.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment, Centralized and Client/Server Architectures for DBMSs, Classification of Database Management Systems, Oracle and MySQL database architecture.

**Module - 2** **08 Hours**

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER Diagrams, Naming Conventions, and Design Issues, Example of Other Notation: UML Class Diagrams Mapping conceptual design into a logical design: Relational database design using ER to relational mapping
**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

**Module – 3** **08 Hours**

**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database. No SQL and difference between SQL and NOSQL.
**Advanced Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Advanced Aggregation Features: Ranking – dense rank, partition by

**Module – 4** **08 Hours**

**SQL Programming Techniques:** Overview of Database Programming Techniques and Issues, Embedded SQL, Dynamic SQL, and SQLJ, JDBC: SQL Class Library for Java Programming, Database Stored Procedures.

**Normalization:** Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

**Module – 5** **08 Hours**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Transaction support in SQL.

**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

**PRACTICAL COMPONENT** **20 Hours**

**List of Experiments**

1. Draw an E-R diagram and map it to relation table for a given scenario. (Order Database, Cricket Database, Movie Database, College Database, Voter Database, etc)
2. Normalize the tables.
3. Perform the following:
   Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
4. Perform the following:
   Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.
5. For a given set of relation schemes, create tables and perform the following
   i. Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions
   ii. Join Queries- Inner Join, Outer Join
   iii. Subqueries- With IN clause, With EXISTS and NOT EXISTS clause
6. For a given set of relation tables perform the following
   Creating Views (with and without check option), Dropping views, Selecting from a view
7. Demonstrate the core concepts on table like procedure and trigger queries and also rank() function.

**Reference:**
https://www.youtube.com/watch?v=AA-KL1jbMeY
https://www.youtube.com/watch?v=7S_tz1z_5bA
https://www.youtube.com/watch?v=lBpSMeQjNqQ
https://www.youtube.com/watch?v=_yog7h4BokQ
https://www.youtube.com/watch?v=hSiCUNVKJAo
https://www.youtube.com/watch?v=IqQhPlJP64k
https://www.youtube.com/watch?v=horURQewW9c
https://www.youtube.com/watch?v=P7-wKbKrAhk
https://www.youtube.com/watch?v=MSbzErdcb6g
https://www.youtube.com/watch?v=QFj-hZi8MKk

**Course Outcomes:**
1. Demonstrate the basic elements of a relational database management system.
2. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
3. Create, populate and manage relational databases in SQL.
4. Extend normalization for the development of application software.
5. Analyze and implement transaction processing, concurrency control, and database recovery protocols in database.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata Mcgraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

**E-Resources:**
https://www.youtube.com/watch?v=wOD02sezmX8
https://www.youtube.com/watch?v=hlGoQC332VM
https://www.youtube.com/watch?v=NNpFHQl_GT0
https://www.youtube.com/watch?v=EGEwkad_llA
https://www.youtube.com/watch?v=t5hsV9lC1rU

**Semester: IV**

**Course Name: ANALYSIS AND DESIGN OF ALGORITHMS**

| | | | |
|---|---|---|---|
| Course Code | **22AI44** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **03** |

**Course Objectives**

1. Describe basic concepts, notations, methods used in design and analysis of algorithms
2. Explain various algorithm design techniques.
3. Design and analyze the efficiency of a given problem using various design techniques.
4. Differentiate efficiency of different algorithm design techniques for a given problem.
5. Apply the suitable algorithm design technique for a given problem.

**Module – 1** **08 Hours**

**Introduction:**
Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithm, Mathematical Analysis of Recursive Algorithms.

**Module - 2** **08 Hours**

**Brute Force and Exhaustive Search:** Selection Sort and Bubble Sort, Exhaustive Search.
**Decrease-and-Conquer:** Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decrease by- a-Constant-Factor Algorithms: Binary Search, Variable-Size-Decrease Algorithm: Euclids Algorithm

**Module – 3** **08 Hours**

**Divide-and-Conquer:** Recurrence equation for divide and conquer, Master Theorem, Finding the maximum and minimum, Mergesort, Quicksort, Binary Search, Strassen's Matrix Multiplication.
Transform-and-Conquer: Presorting, Heaps and Heapsort, Problem Reduction Computing the Least Common Multiple.

**Module – 4** **08 Hours**

**Greedy Method:** General method, Knapsack Problem, Job sequencing with deadlines, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm
**Dynamic Programming:** The Knapsack Problem, Warshall's and Floyd's Algorithms. Bellman-Ford Algorithm, Travelling Sales Person problem.

**Module – 5** **08 Hours**

**Backtracking:** *n*-Queens Problem, Subset-Sum Problem, Graph coloring, Hamiltonian cycles.
**Branch-and-Bound:** Knapsack Problem, Traveling Salesman Problem, Job Assignment Problem.
**NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

**Course Outcomes:**

1. Apply the basic knowledge of mathematical fundamentals for finding time complexity of recursive and non-recursive algorithms.
2. Describe various algorithm design techniques to solve a given problem.
3. Apply various design techniques to find the time complexity of a given problem
4. Compare efficiency of different algorithm design techniques for a given problem
5. Choose the appropriate algorithm design techniques for a given problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to the Design and Analysis of Algorithms | Anany Levitin | Pearson | 2nd Edition, 2009 |
| 2 | Computer Algorithms/C++ | Ellis Horowitz, Satraj Sahni and Rajasekaran | Universities Press | 2nd Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein | PHI | 3rd Edition, 2009 |
| 2 | Design and Analysis of Algorithms | S. Sridhar | Oxford, Higher Education | 2014 |

**Semester: IV**
**Course Name: ALGORITHMS LAB**

| | | | |
|---|---|---|---|
| Course Code | **22AIL45** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Course Objectives:**
1. Demonstrate the basics concepts of Java Programming.
2. Illustrate Different Sorting Algorithm design techniques.
3. Solve Graph Applications using various design techniques.
4. Interpret combinatorial problems using Backtracking technique.
5. Develop skills to identify suitable algorithm design technique to solve a given problem

**List of Experiments:**
**Identify the functional requirements, then Design and Develop solutions to the problems related to the following Algorithm design techniques**

1. Brute Force technique
2. Decrease-and-Conquer method
3. Divide-and-Conquer technique
4. Transform-and-Conquer technique
5. Greedy Method
6. Dynamic Programming
7. Backtracking

**Course outcomes:**
1. Design programs to implement basic concepts of java programs.
2. Apply various algorithm design techniques to solve sorting problems.
3. Implement graph Applications using various design techniques.
4. Execute programs on combinatorial problems using Backtracking technique.
5. Choose appropriate design technique to solve a given problem.

**Semester: IV**
**Course Name: SYSTEM SOFTWARE**

| | | | |
|---|---|---|---|
| Course Code | **22AI461** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
1. Basic Computer organization and architecture
2. Basic concepts of Operating System
3. Good programming skills in C and data structures

**Course objectives:**
1. Distinguish between system software and application software
2. Categorize the instruction formats and addressing modes of SIC and SIC/XE machine.
3. Write the object code for SIC and SIC/XE machine programs
4. List the steps involved to design a Bootstrap loader
5. Apply regular expressions to develop programs using LEX and YACC tools.

**Module – 1** **08 Hours**

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples. Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

**Module – 2** **08 Hours**

Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations – 1 Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.

**Module – 3** **08 Hours**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

**Module – 4** **08 Hours**

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

**Module – 5** **08 Hours**

Lex and Yacc - The Simplest Lex Program, Recognizing Words with LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running 43 LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.
Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.

**Course outcomes:**

- Design programs to implement basic concepts of java programs.
- Apply various algorithm design techniques to solve sorting problems.
- Implement graph Applications using various design techniques.
- Execute programs on combinatorial problems using Backtracking technique.
- Choose appropriate design technique to solve a given problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | System Software | Leland L.Beck D Manjula | Pearson Education | 3rd Ed, 2012 |
| 2 | Lex and Yacc | John R. Levine, Tony Mason and Doug Brown | O'Reilly | 2012 |
| **Reference Books** | | | | |
| 1 | System Programming and Operating Systems | D.M. Dhamdhere, | Tata McGraw - Hill | 3rd Ed, 2013. |
| 2 | Systems programming | Srimanta Pal | Oxford university press | 2016 |

**Semester: IV**

**Course Name: OBJECT ORIENTED PROGRAMMING WITH PYTHON**

| | | | |
|---|---|---|---|
| Course Code | **22AI462** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **3** |

**Pre-requisites:**
- Basic Knowledge of Programming
- Basic Knowledge of MS word, Excel and PDF

**Course objectives:**
1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples and dictionaries.
3. Demonstrate the use of built-in functions of file system.
4. Implement the Object Oriented Programming concepts in Python.
5. Appraise the need for working with various documents like Excel, PDF, Word and Others.

**Module – 1** **08 Hours**

**Python Basics,** Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Module - 2** **08 Hours**

**Lists,** The List Data Type, working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods

**Module – 3** **08 Hours**

**Reading and Writing Files,** Files and File Paths, The os path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat() Function, Project: Generating Random Quiz Files, Project: Multi clipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

**Module – 4** **08 Hours**

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Module – 5**

**Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts,
**Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data, The csv Module**

**Course Outcomes:**
1. Demonstrate proficiency in handling of loops and creation of functions.
2. Identify the methods to create and manipulate lists, tuples and dictionaries.
3. Utilize built-in functions to navigate the file system.
4. Apply the concepts of Object-Oriented Programming to different applications
5. Develop proficiency in working with Excel spreadsheets, PDF and Word documents, CSV files, and JSON data

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist", | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| Reference Books | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press /Taylor & Francis | 1st Edition,2018 |

**e-Resources:**
https://automatetheboringstuff.com
http://greenteapress.com/thinkpython2/thinkpython2.pdf)

**Semester: IV**
**Course Name: INTRODUCTION TO DATA ANALYTICS**

| | | | |
|---|---|---|---|
| Course Code | **22AI463** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module - 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.
8 Hours

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, Sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

| |
|---|
| Introduction, decision tree problem, decision tree construction, decision tree algorithms.<br>Advanced data visualization- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices. |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | McGraw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools, and Practices | Dr.Gaurav Aroraa Chitra Lele Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: IV**

**PROFESSIONAL SKILLS FOR THE WORK PLACE**

| | | | |
|---|---|---|---|
| Course Code | **22PSW47** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **30** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
1. Basic Conversational English
2. Fundamentals of Mathematics
3. Basic Knowledge of Reasoning

**Module – 1** **06 Hours**

**Communication Skills**
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

**Module – 2** **06 Hours**

**Presentation Skills**
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

**Module – 3** **06 Hours**

**Verbal & Numerical Ability**
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

**Module – 4** **06 Hours**

**English Language**
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors.

**Module – 5** **06 Hours**

**Verbal Ability and Verbal Reasoning**
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

**Course Outcomes:**
1. Demonstrate communicative ability in a professional environment
2. Articulate one's ideas and demonstrate them to an audience
3. Transform one's English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Reasoning N' Reasoning - Verbal & Non-verbal Reasoning | Dr. Ravi Chopra | Galgotia | 1994 |
| 2 | Magical Book on Quicker Math | M. Tyra | BSC | I Edition, 2018 |
| 3 | Communicate With Confidence | Diana Booher | Mc-Graw-Hill | Nov 2011 |
| **Reference Books** | | | | |
| 1 | Cambridge Advanced Learner's Dictionary | Cambridge University Press | CBS | IV Edition, 2013 |
| 2 | A Modern Approach to Verbal and Non-verbal Reasoning | R S Agarwal | S Chand | II Edition, 2018 |
| 3 | Word Power Made Easy | Norman Lewis | Goyal Publishers | IV Edition, 2014 |
| 4 | Speak With Confidence | Diana Booher | Mc-Graw-Hill | I Edition, 2002 |

**Semester: IV**
**UNIVERSAL HUMAN VALUES (UHV)**

| | | | |
|---|---|---|---|
| Course Code | **22UH48** | CIE Marks | **50** |
| Teaching Hours / Week (L: T:P: S) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15 hour Theory Session +15 hour Self study** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01 Hour** |
| Examination type (SEE) | **SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions).** | | |

**Course objectives:**
This course is intended to:
1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evaluation.
7. Encourage the students for group work to improve their creative and analytical skills.

**Module-1** **03 hours**

| |
|---|
| **Introduction to Value Education:**<br>Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations |

**Module-2** **03 hours**

**Harmony in the Human Being :**
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

**Module-3** **03 hours**

**Harmony in the Family and Society :**
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

**Module-4** **03 hours**

**Harmony in the Nature / Existence:**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

**Module-5** **03 hours**

**Implications of the Holistic Understanding – a Look at Professional Ethics:**
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

**Course Outcome (Course Skill Set)**

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**Expected to positively impact common graduate attributes like:**

- Ethical human conduct
- Socially responsible behaviour
- Holistic vision of life
- Environmentally responsible work
- Having Competence and Capabilities for Maintaining Health and Hygiene

**Appreciation and aspiration for excellence (merit) and gratitude for all**

**Suggested Learning Resources:**

**Books for READING:**

Text Book and Teachers Manual

- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
- The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

**Reference Books:**

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews

**Semester: IV**

**PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II**

| | | | |
|---|---|---|---|
| Course Code | **22PE49** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organization and administration of sports and games.

**Module IV: Ethics and Moral Values** **5 Hours**

Ethics in Sports
Moral Values in Sports and Games

**Module V: Specific Games (Any one to be selected by the student)** **20 Hours**

Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
Throw ball – Service, Receive, Spin attack, Net Drop & Jump throw.
Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.
Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.
Athletics (Track / Field Events) – Any event as per availability of Ground.

**Module VI: Role of Organization and Administration** **05 Hours**

Scheme of Teaching and Evaluation for

# B.E – V & VI Semester

# Artificial Intelligence & Machine Learning

(2021 Scheme)

**Scheme of Teaching and Evaluation for B.E Programs**
**With effect from the academic year 2021-22**

**Total Credits for B.E.: 160**
**Credits Distribution as per NEP 2020**

| SEM | HS | BS | ES | PC | PE | AEC | OE | PW | INT | SE | UHV | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | **20** |
| 2 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | **20** |
| 3 | 1 | 3 | - | 12 | - | 2 | - | - | - | - | - | **18** |
| 4 | 1 | 3 | - | 12 | - | 3 | - | - | 2 | - | 1 | **22** |
| 5 | 1 | - | - | 11 | 3 | 2 | 3 | - | - | - | - | **20** |
| 6 | 3 | - | - | 8 | 3 | 1 | 3 | 2 | 2 | - | - | **22** |
| 7 | - | - | - | 7 | 3 | - | 3 | 8 | - | - | - | **21** |
| 8 | - | - | - | 3 | - | - | - | - | 13 | 1 | - | **17** |
| **TOTAL** | **10** | **20** | **20** | **53** | **9** | **10** | **9** | **10** | **17** | **1** | **1** | **160** |

| SN | Course Area | Credit Distribution |
|---|---|---|
| 1 | Humanities Social Sciences including Management (HS) | **10** |
| 2 | Basic Sciences (BS) | **20** |
| 3 | Engineering Sciences (ES) | **20** |
| 4 | Professional Core (PC) | **53** |
| 5 | Professional Electives (PE) | **09** |
| 6 | Ability Enhancement Course(AEC) | **10** |
| 7 | Open Electives | **09** |
| 8 | Project Work(Mini/Major) | **10** |
| 9 | Internship(INT) | **17** |
| 10 | Seminar (SE) | **01** |
| 11 | Universal Human Values(UHV) | **01** |
| 12 | Mandatory Non-Credit Course (MNC) | **-** |
| | **Total** | **160** |
| The above is based on the VTU guidelines and the AICTE Model Curriculum | | |

# V SEMESTER

| SN | Course category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration Of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | PCC | 21AI51 | Artificial Intelligence | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21AI52 | Digital Image Processing | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CS53 | Database Management System | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CS54X | Professional Elective – 1 | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CS55X | Open Elective - 1 | Other departments offering the course | Other departments offering the course | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CSL56 | DBMS Lab with Mini Project | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21AIL57 | Artificial Intelligence Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| **08** | **AEC** | **21ADA580** | **Advanced Aptitude** | **Humanities** | **Humanities** | **1** | **0** | **0** | **1** | **2** | **50** | **50** | **100** |
| 09 | AEC | 21CS58X | AEC | Concerned Department | CSE | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| **10** | **HS** | **21ENV59** | **Environmental Studies** | **Humanities** | **Humanities** | **1** | **0** | **0** | **1** | **2** | **50** | **50** | **100** |
| | **Total** | | | | **20** | | **500** | **500** | **1000** | | | | |

**Ability Enhancement Course**

| | | |
|---|---|---|
| 01 | 21CS581 | C# and .Net Framework |
| 02 | 21CS582 | PYTHON Programming |

**Professional Elective – 1**

| | | |
|---|---|---|
| 01 | 21CS541 | Agile Technology |
| 02 | 21CS542 | Introduction to Data Analytics |
| 03 | 21CS543 | Cyber Security |

**Open Elective -1**

| | | |
|---|---|---|
| 01 | 21CS551 | Introduction to Data Structures |
| 02 | 21CS552 | Introduction to Database Management Systems |
| 03 | 21CS553 | Introduction to PYTHON Programming |
| 04 | 21CS554 | Introduction to Operating System |

## VI SEMESTER

| SN | Course Category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | HS | 21CS61 | Software Project Management | Humanities / Concerned Department | Humanities / CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21AI62 | Machine Learning | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21AI63 | Java For Mobile Applications | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CS64X | Professional Elective – 2 | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CS65X | Open Elective - 2 | Other departments offering the course | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21AIL66 | Machine Learning Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21AIL67 | Mobile Application Development Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | PW | 21MN68 | Mini Project | Concerned Department | CSE | Two contact hours / week for interaction between the faculty and students | | | 2 | 3 | 50 | 50 | 100 |
| 09 | AEC | 21CS69X | AEC | Concerned Department | CSE | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 10 | INT | 21INT691 | Summer Internship-II | Completed during the intervening period of IV and V semesters. | | | | | 2 | --- | 100 | - | 100 |
| | **Total** | | | | | | | | **22** | | **550** | **450** | **1000** |

**Ability Enhancement Course**

| | | |
|---|---|---|
| 01 | 21CS69A | Computer Graphics USING Open GL |
| 02 | 21CS69B | Mobile Application Development |
| 03 | 21CS69C | Robotic Process Automation |

**Professional Elective – 2**

| | | |
|---|---|---|
| 01 | 21CS641 | Cloud Computing |
| 02 | 21CS642 | Block Chain Technology |
| 03 | 21CS643 | Natural Language Processing |

**Open Elective -2**

| | | |
|---|---|---|
| 01 | 21CS651 | Programming in JAVA |
| 02 | 21CS652 | Introduction to Data Analytics |
| 03 | 21CS653 | Introduction to Artificial Intelligence & Machine Learning |
| 04 | 21CS654 | Introduction to Cyber Security |

**Summer Internship – II (21INT691):**

All the students admitted to engineering programmes shall have to undergo a mandatory internship-II of 04 weeks during the intervening vacation of IV and V semesters.

All the students TAKING FAST TRACK /SUPPLEMENTARY SEMESTER shall have to undergo a mandatory internship-II of 04 weeks during the intervening period of V and VI semesters. Internship-II shall include Innovation/ Entrepreneurship / Societal based Internship. A Viva-voce examination (Presentation followed by question-answer session) shall be conducted during VI semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examinations after satisfying the internship requirements The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.

**Scheme of Teaching and Evaluation for**

# B.E – V Semester

# Artificial Intelligence & Machine Learning

**(2021 Scheme)**

## Semester: V
## Course Name: PRINCIPLES OF ARTIFICIAL INTELLIGENCE

| | | | |
|---|---|---|---|
| Course Code | **21AI51** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:** Knowledge of a programming language and Mathematical knowledge.

**Course objectives:**
1. Gain a historical perspective of AI and its foundations
2. Become familiar with basic principles of AI toward problem solving
3. Get to know approaches of inference, perception, Uncertain Knowledge and Reasoning.
4. Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool.
5. Experiment with a machine learning model for simulation and analysis.

**Module – 1** **08 Hours**

**Introduction:** Foundations and History of AI
**Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

**Module – 2** **08 Hours**

**Problem-Solving:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search

**Module – 3** **08 Hours**

**Informed Search Strategies:** Heuristic functions, Greedy best first search, A*search. Heuristic Functions
**Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

**Module – 4** **08 Hours**

**First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.
**Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution

**Module – 5** **08 Hours**

**Uncertain Knowledge and Reasoning:** Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye’s Rule and its use. Wumpus World Revisited

**Course Outcomes:**
At the end of the course the student will be able to:
1. Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
2. Analyse Searching and Inferencing Techniques.
3. Develop knowledge base sentences using propositional logic and first order logic
4. Demonstrating agents, searching and inferencing
5. Illustrate the application of probability in uncertain reasoning

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence | Stuart J. Russell and Peter Norvig | Pearson | 3rd Edition,2015 |
| **Reference Books** | | | | |
| 1 | Introduction to Machine Learning | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3rd 2013 |
| 2 | Artificial Intelligence Structure and strategies for complex | George F Lugar | Pearson Education | 5th Edition 2011 |

## Semester: V
## Course Name: DIGITAL IMAGE PROCESSING

| | | | |
|---|---|---|---|
| Course Code | **21AI52** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:** Knowledge of Programming skills in C.

**Course objectives:**
1. Understand the fundamentals of Digital Image Processing
2. Explain the process of image transformation used in Digital Image Processing
3. Illustrate the image enhancement techniques used in Digital Image Processing
4. Describe the image restoration techniques and methods used in Digital Image Processing
5. Explain the Morphological Operations and Segmentation used in Digital Image Processing

**Module – 1** **08 Hours**

**Digital Image Fundamentals:** Introduction to Digital Image Processing, Origins of Digital Image, Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

**Module - 2** **08 Hours**

**Spatial Domain:** Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering,-Smoothing Spatial Filters, Sharpening Spatial Filters FREQUENCY DOMAIN: Preliminary Concepts, The Discrete Fourier Transform(DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering

**Module – 3** **08 Hours**

**Restoration:** Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering.

**Module – 4** **08 Hours**

**Color Image Processing:** Color Fundamentals, Color Models, and Pseudo-color Image Processing.
**Wavelets:** Background, Multiresolution Expansions.
**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms and Some Basic Morphological Algorithms.

**Module – 5** **08 Hours**

**Segmentation:** Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection and Principles of Thresholding.
**Representation and Description:** Representation, and Boundary descriptors.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Understand, ascertain and describe the basics of image processing concepts through mathematical interpretation.
2. Apply image processing techniques in both the spatial and frequency (Fourier) domains.
3. Demonstrate image restoration process and its respective filters required.
4. Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
5. Conduct independent study and analysis of Image Enhancement techniques

***Suggested Learning Resources:***

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Image Processing | Rafael C. Gonzalez and Richard E. Woods, | Prentice Hall | $3^{rd}$Edition,2008 |
| 2 | Digital Image Processing | S. Sridhar, | Oxford University Press, | $2^{ND}$Edition,2008 |
| **Reference Books** | | | | |
| 1 | Digital Image Processing | S.Jayaraman, S.Esakkirajan, T.Veerakumar, | Tata McGraw Hill | 2014 |
| 2 | Fundamentals of Digital Image Processing-A. | A.K. Jain, | Pearson | 2004 |

**Semester: V**

**Course Name: DATABASE MANAGEMENT SYSTEMS**

| | | | |
|---|---|---|---|
| Course Code | **21CS53** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**

- Knowledge of programming
- Data structures

**Course objectives:**

1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.
**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

**Module - 2** **08 Hours**

**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping
**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Module – 3** **08 Hours**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.
**Advanced Aggregation Features:** Ranking – dense rank, partition by
**Application Development:** Accessing SQL From a Programming Language, An introduction to JDBC, ODBC, Embedded SQL, SQLJ, Stored procedures

**Module – 4** **08 Hours**

**Normalization: Database Design Theory** – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.
**Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

**Module – 5** **08 Hours**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.
**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multi-version Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

**Course Outcomes:**
1. Demonstrate the basic elements of a relational database management system.
2. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
3. Create, populate and manage relational databases in SQL.
4. Extend normalization for the development of application software.
5. Analyse and implement transaction processing, concurrency control, and database recovery protocols in database.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata McGraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

**Semester: V**
**Course Name: AGILE TECHNOLOGY**

| | | | |
|---|---|---|---|
| Course Code | **21CS541** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of Software Engineering and Programming Language

**Course objectives:**
1. Explain the fundamental concepts of agile software engineering
2. Demonstrate the need to apply the principles of XP life cycle.
3. Evaluate various functionalities of XP programming.
4. Demonstrate concepts to Eliminate Waste

**Module – 1** **08 Hours**

**Agile:** Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **Agile Methods,** Don't Make Your Own Method, The Road to Mastery, Find a Mentor

**Module - 2** **08 Hours**

**Understanding XP:** The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us, Go!, Assess Your Agility

**Module – 3** **08 Hours**

**Practicing XP: Thinking:** Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting,
**Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.
**Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

**Module – 4** **08 Hours**

**Mastering Agility:** Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading,
**Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People,
**Eliminate Waste:** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

**Module – 5** **08 Hours**

**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently,
**Seek Technical Excellence:** Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

**Course Outcomes:**

1. Interpret the concept of agile software engineering and its advantages in software development
2. Outline XP Lifecycle, XP Concepts, Adopting XP
3. Apply the principles of XP for real time examples.
4. Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
5. Demonstrate concepts to Eliminate Waste

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The Art of Agile Development | James shore, Chromatic, | O'Reilly | 2007 |
| **Reference Books** | | | | |
| 1 | Agile Software Development, Principles, Patterns, and Practices | Robert C. Martin | Prentice Hall | 1st edition, 2002 |
| 2 | Agile and Iterative Development A Manger's Guide | Craig Larman | Pearson Education | First Edition, India, 2004 |

**Semester: V**
**Course Name: INTRODUCTION TO DATA ANALYTICS**

| | | | |
|---|---|---|---|
| Course Code | **21CS542** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module – 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
Advanced data visualization- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Data Analytics | Anil Maheshwari | McGraw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: V**
**Course Name: CYBER SECURITY**

| | | | |
|---|---|---|---|
| Course Code | **21CS543** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:** The students should have the knowledge of:
- Awareness about the loopholes/drawbacks of the advanced technologies on which the society is dependent.
- Awareness about the crimes being done through technology.

**Course objectives:**
1. To familiarize the cybercrime terminologies and perspectives.
2. To illustrate the phases of cybercrime plan and different types of cybercrimes.
3. To gain the knowledge about the tools and methods used by the criminals.
4. To reveal the techniques used in phishing and identity theft.
5. To emphasize the necessary of computer and cyber forensics.

**Module – 1** **08 Hours**

**Introduction to Cybercrime:**
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**Module - 2** **08 Hours**

**Cyber Offenses:**
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

**Module – 3** **08 Hours**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

**Module – 4** **08 Hours**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

**Module – 5** **08 Hours**

Understnading Computer Forensics: Introdcution, Historical Background of Cyberforensics, Digital Foresics Science, Need for Computer Foresics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**Course Outcomes:**
1. Identify the various terminologies being used in cybercrime.
2. Categorize the types of cybercrimes.
3. Illustrate the tools and methods used by criminals for cybercrime.
4. Compare the various techniques used in phishing and identity theft.
5. Utilize various cyber security techniques including cyber forensics.

**Suggested Learning Resources:**

**Text Books:**

Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

**Reference Books:**

Neil Daswani, Moudy Elbayadi Big Breaches: "Cyber-security Lessons for Everyone", Feb 2021

## Semester: V
## Course Name: DATABASE MANAGEMENT SYSTEM LAB WITH MINI PROJECT

| | | | |
|---|---|---|---|
| Course Code | **21CSL56** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course Objectives:**
1. Create a database using fundamental SQL commands.
2. Analyze the database concepts to design a schema diagram.
3. Retrieving the data from the database.
4. Performing database operations in a procedural manner using SQL.
5. Design and develop applications like Employee, Movie management systems etc.

**List of Experiments:**

**Part A**

**Identify the functional requirements, then Design Develop solutions to the problems related to:**

**1. Aim:** Discuss the various concepts on constraints and update operations.

Program: Consider the following schema for Order Database:
SALESMAN(Salesman_id, Name, City, Commission)
CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Write SQL queries to
1. Count the customers with grades above Bangalore's average.
2. Find the name and numbers of all salesman who had more than one customer.
3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
4. Create a view that finds the salesman who has the customer with the highest order of a day.
5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

**Reference:**
https://www.youtube.com/watch?v=AA-KL1jbMeY
https://www.youtube.com/watch?v=7S_tz1z_5bA

**2. Aim:** Demonstrating creation of tables, applying the nested query concepts.

Program Consider the following schema for a Cricket Database:
TEAM( tid, tname, coach, captain_pid , city)
PLAYER( pid, pname, age, tid)
STADIUM(sid, sname, pincode, city)
MATCH(mid, mdate, time, sid, team1_id, team2_id, winning_team_id, man_of_match, pid)
Write SQL queries to
1. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
2. List the details of the stadium where the maximum number of matches were played.
3. List the details of the player who is not a captain but got the man_of _match award at least in two matches.
4. Display the Team details who won the maximum matches.
5. Display the team name where all its won matches played in the same stadium.

**Reference:**
https://www.youtube.com/watch?v=lBpSMeQjNqQ
https://www.youtube.com/watch?v=_yog7h4BokQ

**3. Aim:** Demonstrate the concepts of JOIN operations.

Program: Consider the schema for Movie Database:ACTOR(Act_id, Act_Name, Act_Gender)
DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)

**Write SQL queries to**

1. List the titles of all movies directed by ‘Hitchcock’.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by ‘Steven Spielberg’ to 5.

**Reference:**
https://www.youtube.com/watch?v=hSiCUNVKJAo
https://www.youtube.com/watch?v=IqQhPlJP64k

**4. Aim:** Introduce concepts of PLSQL and usage on the table.

Program: Consider the schema for College Database:
STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID)
COURSE(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

**Write SQL queries to**

1. List all the student details studying in fourth semester ‘C’ section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN ‘1BI15CS101’ in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
   If FinalIA = 17 to 20 then CAT = ‘Outstanding’
   If FinalIA = 12 to 16 then CAT = ‘Average’
   If FinalIA< 12 then CAT = ‘Weak’
   Give these details only for 8th semester A, B, and C section students.

**Reference:**
https://www.youtube.com/watch?v=horURQewW9c
https://www.youtube.com/watch?v=P7-wKbKrAhk

**5. Aim:** Demonstrate the core concepts on table like procedure and trigger queries and also rank() function.

Program: Consider the schema for Voter Database:
CONSTITUENCY(cons_id, csname, csstate, no_of_voters)
PARTY(pid, pname, psymbol)
CANDIDATES(cand_id, phone_no, age, state, name, pid)
CONTEST(cons_id, cand_id)
VOTER(vid, vname, vage, vaddr, cons_id, cand_id)

**Write SQL queries to**

1. List the details of the candidates who are contesting from more than one constituency which are belongs to different states.
2. Display the state name having maximum number of constituencies.
3. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg".
4. Display the constituency name, state and number of voters in each state in descending order using rank() function'
5. Create a TRIGGER to UPDATE the count of "Number_of_voters" of the respective constituency in "CONSTITUENCY" table, AFTER inserting a tuple into the "VOTERS" table.

**Reference:**
https://www.youtube.com/watch?v=MSbzErdcb6g
https://www.youtube.com/watch?v=QFj-hZi8MKk

**Part B**

**Mini Project:** For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc. Demonstrate by using front-end tools with reports

**Course outcomes:**
1. Apply fundamentals of SQL commands to construct a database.
2. Analyze and Design database schema for a given problem domain.
3. Design and implement various databases (Ex. Cricket, Movies etc.)
4. Evaluate nested queries for data manipulation.
5. Design, Develop and Evaluate mini project using modern tools(Like Oracle, MySQL, NetBeans, Eclipse, Apache Tomcat)

## Semester: V
## Course Name: ARTIFICIAL INTELLIGENCE LAB

| | | | |
|---|---|---|---|
| Course Code | **21AIL57** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course Objectives:**
1. Explain different search methods to solve different AI problems
2. Understand the application of heuristic approach to solve problems
3. Demonstrate forward and backward chaining problem solving techniques.
4. Understand the game playing strategies
5. Describe FOPL and its applications

**List of Experiments:**

**Part A**

**Practicing Problems in Python (Students can be encouraged to practice good number of practice problems, some practice problems are listed here)**
1. (a) Write a python program to print the multiplication table for the given number
   (b) Write a python program to check whether the given number is prime or not?
   (c) Write a python program to find factorial of the given number?
2. (a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)
   (b) Write a python program to implement List methods (Add, Append, and Extend& Delete).
3. Write a python program to implement simple Chabot with minimum 10 conversations
4. Write a python program to Illustrate Different Set Operations
5. (a) Write a python program to implement a function that counts the number of times a string (s1) occurs in another string(s2)
   (b)Write a program to illustrate Dictionary operations ([], in, traversal)and methods: keys (),values(),items()

**Part B**

**AI Problems to be implemented in Python**
1. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2. Implement and Demonstrate Best First Search Algorithm on any AI problem
3. Implement AO* Search algorithm.
4. Solve 8-Queens Problem with suitable assumptions
5. Implementation of TSP using heuristic approach
6. Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining
7. Implement resolution principle on FOPL related problems
8. Implement any Game and demonstrate the Game playing strategies

**Course outcomes:**
The student will be able to:-
1. Implement DFS and BFS algorithms to solve AI problems
2. Design and Develop applications using heuristic search method.
3. Implement forward and backward chaining problem solving techniques.
4. Demonstrate game using game playing strategies
5. Solve AI problems using suitable search strategies

**Semester: V**
**Course Name: Advanced Aptitude**

| | | | |
|---|---|---|---|
| Course Code | **21ADA580** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:**
1. Fundamentals of Mathematics
2. Basic knowledge of Reasoning

**Module – 1: Numerical Ability Based** **03 Hours**

Simplifications, Squares and Square Roots, Cubes and Cube roots, BODMAS Rule, LCM, HCF, Fractions and Decimals

**Module – 2: Percentage Based** **03 Hours**

Percentages, Profit and Loss, Discounts, Simple Interest and Compound Interest

**Module – 3: Time Based** **03 Hours**

Time and Work, Pipes and Cisterns, Time and Distance, Trains, Boats and Streams

**Module – 4: Ratio Based** **03 Hours**

Ratio-proportion, Partnership, Averages and Ages

**Module – 5: Logical and Analytical Based** **03 Hours**

Seating Arrangement, Series, Analogy, Odd man out and Blood Relations



**Course Outcomes:**
**At the end of course students will be able to**
1. Analyze and solve questions based on logical thinking and critical reasoning.
2. Analyze and solve quantitative aptitude problems
3. Solve aptitude problems using fast track techniques
4. Solve puzzle based questions
5. Analyze and solve problems on numerical computation and numerical estimation

## Semester V
## Course Name: Environmental Studies

| | | | |
|---|---|---|---|
| Course Code | **21ENV59** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:** Water supply and treatment engineering.

**Course objectives:**
1. Understand and evaluate the global scale of environmental problems
2. Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world

**Module – 1** **08 Hours (RBT Levels: L1, L2, L3)**

**Ecosystems (Structure and Function):** Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
**Biodiversity:** Types, Threats and Conservation of biodiversity. Forest Wealth, and Deforestation**.**

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

**Advances in Energy Systems (Merits, Demerits, Global Status and Applications):** Hydrogen, Solar, OTEC, Tidal and Wind.
**Natural Resource Management (Concept and case-studies**): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

**Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts,)**: Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

**Global Environmental Concerns (Concept, policies and case-studies**): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology**.**

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.IS. & Remote Sensing. Environment Impact Assessment. Environmental Management Systems.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, you tube videos.

**Course Outcomes:**
1. **Understand** the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale. Estimate runoff and develop unit hydrographs.
2. **Develop** critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. **Demonstrate** ecology knowledge of a complex relationship between biotic and a biotic component**.**

4. **Apply** their ecological knowledge to illustrate and graph a problem.
5. Describe the realities that managers face when dealing with complex issues.

**Assessment Details**
CIE:

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**SEE:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 01 hours) 1. The question paper will have fifty questions. Each question is set for 01 marks. 2. There will be 10 questions from each module. Each of the 10 questions under a module, should have a mix of topics under that module. The students have to answer 50 multiple choice questions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | **Textbooks** | | | |
| 1 | Environmental Studies | S M Prakash | Pristine Publishing House, Mangalore | 3rd Edition, 2018 |
| 2 | **Environmental Studies** | Benny Joseph | Tata Mc Graw-Hill, 2nd Edition | 2012 |
| 3 | Environmental Studies – From Crisis to Cure R | Rajagopalan | Oxford Publisher | 2005 |
| | | | | |
| 1 | Principals of Environmental Science and Engineering | Raman Sivakumar | Cengage learning, Singapur | 2nd Edition, 2005 |
| 2 | Environmental Science - working with the Earth | G.Tyler Miller Jr. | Thomson Brooks /Cole | 11th Edition, 2006 |
| 3 | Text Book of Environmental and Ecology | Pratiba Sing, Anoop Singh & Piyush Malaviya | Acme Learning Pvt. Ltd. New Delhi. | 1st Edition |

## Semester: V
## Course Name: C# AND .NET FRAMEWORK

| | | | |
|---|---|---|---|
| Course Code | **21CS581** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **3** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:** Any Object oriented programming

**Course objectives:**
1. Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
2. Understand Object Oriented Programming concepts in C# programming language.
3. Interpret Interfaces and define custom interfaces for application.
4. Build custom collections and generics in C#
5. Construct events and query data using query expressions

**Module – 1** **03 Hours**

**Introducing Microsoft Visual C# and Microsoft Visual Studio 2015:** Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions

**Module - 2** **03 Hours**

**Understanding the C# object model:** Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays

**Module – 3** **03 Hours**

Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management

**Module – 4** **03 Hours**

**Defining Extensible Types with C#:** Implementing properties to access fields, Using indexers, Introducing generics, Using collections

**Module – 5** **03 Hours**

Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading

**Course Outcomes:**
1. Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
2. Demonstrate Object Oriented Programming concepts in C# programming language
3. Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
4. Illustrate the use of generics and collections in C#
5. Compose queries to query in-memory data and define own operator behavior

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Microsoft Visual C# Step by Step | John Sharp | PHI Learning Pvt. Ltd | 8th Edition, 2016 |
| **Reference Books** | | | | |
| 1 | C# 6 and .NET Core 1.0 | Christian Nagel | Wiley India Pvt Ltd | 1st Edition 2016 |
| 2 | Essential C# 6.0 | Mark Michaelis | Pearson Education India | 5th Edition, 2016 |
| 3 | Prof C# 5.0 and the .NET 4.5 Framework | Andrew Troelsen | Apress and Dreamtech Press | 6th Edition, 2012. |

**Semester: V**
**Course Name: PYTHON PROGRAMMING**

| | | | |
|---|---|---|---|
| Course Code | **21CS582** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of Programming

**Course objectives:**
1. Interpret the basic syntax and semantics of several expressions and functions.
2. Demonstrate the concepts of Iterations and files applied in real world scenario
3. Illustrate the python programs using Strings and Dictionaries.
4. Extend the importance of object oriented programming in python.
5. Implement inheritance concepts to solve real world problems

**Module – 1** **03 Hours**

**Python Basics:** Variables, expressions and statements, Conditional execution, Functions

**Module - 2** **03 Hours**

**Iteration:** While statement, Infinite Loops, definite loops, Loop patterns
**Strings:** String traversal, String Slices, in operator, String methods Format operator
**Files:** Persistence, Opening, reading from text files, using try, except and open, writing to text files

**Module – 3** **03 Hours**

**Lists:** List Operations, slices, methods, lists and functions, list and strings, objects and value, Aliasing, List arguments
**Dictionaries:** Dictionary as a set of counters, Dictionaries and files, Looping and Dictionaries, Advanced text parsing

**Module – 4** **03 Hours**

**Tuples:** Comparing tuples, Tuple assignment, Dictionaries and tuples, Sequences, List comprehension
**Regular Expressions:** Character matching in regular expressions, extracting data using regular expressions, Combining searching and extracting, Escape character

**Module – 5** **03 Hours**

**Classes and objects:** Programmer-defined types, Attributes, Instances as return value, Objects are mutable, Copying
**Classes and functions:** Pure functions, modifiers, prototyping versus planning
**Classes and methods:** Object oriented features, init method, str method, operator overloading, type-based dispatch, polymorphism, Interface and implementation

**Course Outcomes:**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement python data structures to solve real world problems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Python for Everybody: Exploring Data Using Python 3 | Charles R. Severance | CreateSpace Independent Publishing Platform | 1st Edition, 2016 |
| 2 | Think Python: How to Think Like a Computer Scientist | Allen B. Downey | Green Tea Press | 2nd Edition, 2015 |
| **Reference Books** | | | | |
| 1 | Introduction to Computer Science Using Python | Charles Dierbach | CRC Press /Taylor & Francis | 1st Edition,2018 |
| 2 | Programming Python | Mark Lutz | O'Reilly Media | 4th Edition, 2011 |
| 3 | Core Python Applications Programming | Wesley J Chun | Pearson Education India | 3rd Edition, 2015 |

**Semester: V**

**Course Name: INTRODUCTION TO DATA STRUCTURES**

| | | | |
|---|---|---|---|
| Course Code | **21CS551** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Should have a basic knowledge of C Programming.

**Course objectives:**
1. Explain the fundamentals of data structures and their applications to solve real life problems.
2. Demonstrate the working of linear and nonlinear data structures.
3. Write solutions to problems using linear data structures and nonlinear data structures.
4. Apply different data structures to solve given problem.
5. Develop skills to apply appropriate data structures in problem solving.

**Module – 1** **08 Hours**

**Introduction:**
Introduction to Data Structures, Types of data structures, data structure operations.
**Arrays:** one-dimensional arrays, two dimensional arrays, initializing one dimensional and two dimensional arrays, operations on arrays.
**Structures and Unions:** Declaring structures, structure initialization, Introduction to unions
Functions: Built-in functions and user defined functions.

**Module - 2** **08 Hours**

**Linear Data Structures-Stacks and Queues:**
Introduction, Stack representation in Memory, Stack Operations, Stack Implementation, Applications of Stack, Recursion.
Introduction to Queues-Basic concept, Logical representation of Queues, Queue Operations and its types, Queue Implementation, Applications of Queue.

**Module – 3** **08 Hours**

**Linear Data Structures-Linked List:**
Introduction to Pointers: Pointer concepts, accessing variables through pointers, Dynamic memory allocation.
Introduction to Linked list, Logical representation of Linked list, Self-Referential structure, Singly-linked List Operations and its implementation, types of linked lists, introduction to circular linked list.

**Module – 4** **08 Hours**

**Non Linear Data Structures – Trees**
Terminologies, Binary Trees, Properties of Binary trees and representation, Binary Tree Traversal, Binary Search tree and its implementation.

**Module – 5** **08 Hours**

**Non Linear Data Structures–Graphs**: Introduction, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
Hashing: Introduction to hashing, Hashing Functions.

**Course Outcomes:** The student will be able to

1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data structures using C | E Balaguruswamy | McGraw Hill | 2013 Edition |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | 2nd Edition,2014 |
| **Reference Books** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | 2nd Edition, 2014 |

**Semester: V**

**Course Name: INTRODUCTION DATABASE MANAGEMENT SYSTEMS**

| | | | |
|---|---|---|---|
| Course Code | **21CS552** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

**Module - 2** **08 Hours**

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples
**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping

**Module – 3** **08 Hours**

**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Module – 4** **08 Hours**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

**Module – 5** **08 Hours**

**Normalization:** Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.
**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

**Course Outcomes:**

1. Demonstrate the basic elements of a relational database management system.
2. Identify the data models for relevant problems.
3. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
4. Create, populate and manage relational databases in SQL.
5. Extend normalization for the development of application software

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata McGraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

## Semester: V
## Course Name: INTRODUCTION TO PYTHON PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **21CS553** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of Programming
- Basic Knowledge of MS word, Excel and PDF

**Course objectives:**
1. Interpret the basic syntax and semantics of several expressions and functions.
2. Demonstrate the concepts of Iterations and files applied in real world scenario
3. Illustrate the python programs using Strings and Dictionaries.
4. Extend the importance of object oriented programming in python.
5. Implement inheritance concepts and File system to solve real world problems

**Module – 1** **03 Hours**

**Python Basics,** Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Module – 2** **03 Hours**

**Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, Dictionaries and **Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods

**Module – 3** **03 Hours**

**Reading and Writing Files**, Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard**, Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

**Module – 4** **03 Hours**

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Module – 5** **03 Hours**

**Working with Excel Spreadsheets**, Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module

**Course Outcomes**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement python data structures to solve real world problems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist”, | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press /Taylor & Francis | 1st Edition,2018 |

## Semester: V
## Course Name: INTRODUCTION TO OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **21CS554** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **3** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:** The students should have the knowledge of:
- Basics of computer system and its applications
- Basics of computer organization

**Course objectives:**
1. To introduce Operating System, OS responsibilities, and OS services.
2. To discuss process concept, process and scheduling techniques.
3. To demonstrate deadlock condition in the computer system.
4. To introduce memory management and virtual memory management concepts.
5. To explain file system.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures**: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.
**Operating System Services:** User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

**Module - 2** **08 Hours**

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication
**Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms.

**Module – 3** **08 Hours**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Module – 4** **08 Hours**

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**Module – 5** **08 Hours**

File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Course Outcomes:**

1. Analyze the need of OS, responsibilities of OS, and OS services.
2. Compare different process scheduling techniques.
3. Examine deadlock situation, prevention, avoidance and recovery.
4. Implement virtual memory management concept and page replacement algorithms.
5. Discuss the file system.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed, 2013. |

**Scheme of Teaching and Evaluation for**

# B.E – VI Semester

# Artificial Intelligence & Machine Learning

**(2021 Scheme)**

## Semester: VI
## Course Name: SOFTWARE PROJECT MANAGEMENT

| | | | |
|---|---|---|---|
| Course Code | **21CS61** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**

**Course objectives:**
1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.

**Module – 1** **08 Hours**

**PROJECT EVALUATION AND PROJECT PLANNING**
Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**Module - 2** **08 Hours**

**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**
Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**Module – 3** **08 Hours**

**ACTIVITY PLANNING AND RISK MANAGEMENT**
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**Module – 4** **08 Hours**

**PROJECT MANAGEMENT AND CONTROL**
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**Module – 5** **08 Hours**

**STAFFING IN SOFTWARE PROJECTS**
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership

**Course Outcomes:**

1. Understand Project Management principles while developing software
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Software Project Management | Bob Hughes, Mike Cotterell and Rajib Mall | Tata McGraw Hill | Fifth and 2011 |
| 2 | Accounting for Management | Jawahar Lal | Wheeler Publications, Delhi | Fifth |
| **Reference Books** | | | | |
| 1 | Effective Software Project Management | Robert K. Wysocki | Wiley Publication | 2011 |
| 2 | Software Project Management | Walker Royce: | Addison-Wesley | 1998 |
| | | | | |

## Semester: VI
## Course Name: MACHINE LEARNING

| | | | |
|---|---|---|---|
| Course Code | **21AI62** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**

- Knowledge about Probability theory, Statistics theory and Linear Algebra.

**Course objectives:**

1. Define machine learning and understand the basic theory underlying machine learning.
2. Differentiate supervised, unsupervised and reinforcement learning
3. Understand the basic concepts of learning and decision trees.
4. Understand Bayesian techniques for problems appear in machine learning
5. Perform statistical analysis of machine learning techniques.

**Module – 1** **08 Hours**

**Introduction:**
Machine learning Landscape: Definition, Why, Types of ML, main challenges of ML
**Concept learning and Learning Problems** – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VS- Inductive bias.

**Module - 2** **08 Hours**

**End to end Machine learning Project:** Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model.
**Classification:** MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification

**Module – 3** **08 Hours**

**Training Models:** Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression
**Support Vector Machine:** Linear, Nonlinear , SVM regression and under the hood

**Module – 4** **08 Hours**

**Decision Trees -**Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability
**Ensemble learning and Random Forest:** Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking

**Module – 5** **08 Hours**

**Bayes Theorem** – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– example-Bayesian Belief Network – EM Algorithm

**Course Outcomes:**
At the end of the course the student will be able to:
1. Understand the concept of Machine Learning and Concept Learning.
2. Apply the concept of ML and various classification methods in a project.
3. Analyze various training models in ML and the SVM algorithm to be implemented.
4. Apply the ML concept in a decision tree structure and implementation of Ensemble learning and Random Forest.
5. Apply Bayes techniques and explore more about the classification in ML

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Machine Learning | Tom M. Mitchell | McGraw-Hill Education | 2013 Edition |
| 2 | Hands-on Machine Learning with Scikit-Learn &TensorFlow , O’Reilly, Shroff | AurelienGeron | Publishers and Distributors Pvt. Ltd | 2019Edition |
| **Reference Books** | | | | |
| 1 | Introduction to Machine Learning | EthemAlpaydin, | PHI Learning Pvt. Ltd | 2$^{nd}$Edition 2013 |
| 2 | Machine Learning using Python | Manaranjan Pradhan, U Dinesh Kumar | Wiley | 2019 Edition |

## Semester: VI
## Course Name: JAVA FOR MOBILE APPLICATION DEVELOPMENT

| | | | |
|---|---|---|---|
| Course Code | **21AI63** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:2:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of JAVA programming

**Course objectives:**
1. To have an insight in to enumerations for storing and processing data
2. To understand the architecture and components of android application
3. To design interactive user interface
4. To work with SQLite database
5. To develop a Mobile Application to solve real world problems

**Module – 1** **08 Hours**

**Enumerations, Autoboxing and Annotations(metadata)**: Enumerations, Enumeration fundamentals, the values () and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, typewrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at runtime by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations

**Module - 2** **08 Hours**

String Handling: The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() to CharArray(), String Comparison, equals( ) and equals IgnoreCase( ), regionMatches( ) startsWith() and endsWith(), equals( ) Versus==, compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer, StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(), append(), insert(), reverse(), delete() and delete CharAt(), replace(), substring(), Additional String Buffer Methods, String Builder

**Module – 3** **08 Hours**

Getting Started with Android Programming: Definition of Android, Features of Android, Android Architecture, obtaining the required tools, launching your first android application
Activities, Fragments and Intents: Understanding activities, linking activities using intents, fragments.

**Module – 4** **08 Hours**

Getting to know the Android User Interface: Views and View Groups, Frame Layout, Linear Layout, Table Layout, Relative Layout, Scroll View
Designing User Interface with Views: TextView view–Button, Image Button, EditText, Checkbox, Toggle Button, Radio Button and Radio Group Views.
Creating and using Databases: Creating the DB Adapter Helperclass, using the database programmatically.

**Module – 5** **08 Hours**

Messaging: Sending SMS, Messages Programmatically, Sending SMS Messages Using Intent, Receiving SMS Messages, Sending Email

Location-Based Services: Displaying Maps, Displaying The Zoom Control, Changing Views, Navigating to A Specific Location, Getting The Location That Was Touched

**Course Outcomes:** The student will be able to-

1. Interpret the need for advanced Java concepts like enumerations in developing modular and efficient programs
2. Understand various application components in android.
3. Design efficient user interface using different layouts.
4. Develop application with persistent data storage using SQLite
5. Develop a Mobile application by taking real world scenario

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | JAVA the Complete Reference | Herbert Schildt | Tata McGraw Hill | 9$^{th}$ Edition, 2007 |
| 2 | J2EE-TheCompleteReference | JimKeogh | McGraw Hill | 2007 |
| 3 | Beginning Android Programming with Android Studio | J.F.DiMarzio | | 4$^{th}$Edition, 2017 |
| **Reference Books** | | | | |
| 1 | Android Programming for Beginners | John Horton | | 1$^{st}$Edition, 2015 |
| 2 | Head First Android Development | Dawn Griffiths & David Griffiths | O'Reilly | 1$^{st}$Edition, 2015 |

**Semester: VI**
**Course Name: CLOUD COMPUTING**

| | | | |
|---|---|---|---|
| Course Code | **21CS641** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of Computer Networks
- Basic Knowledge of DBMS
- Python Programming Knowledge

**Course objectives:**
1. To learn various concepts and technologies of clouds.
2. To identify all the available cloud services
3. To understand the design approaches to cloud applications
4. To utilize Hadoop & MapReduce frameworks for developing cloud applications
5. To develop various cloud based applications using python

**Module – 1** **08 Hours**

**Introduction to Cloud Computing:** Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud-based Services & Applications.
**Cloud Concepts & Technologies:** Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring.

**Module – 2** **08 Hours**

**Cloud Concepts & Technologies:** Software Defined Networking, Network Function Virtualization, MapReduce, Identity and Access Management, Service Level Agreements, Billing.
**Cloud Services & Platforms:** Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment & Management Services, Identity & Access Management Services, Open Source Private Cloud Softwar

**Module – 3** **08 Hours**

**Hadoop & MapReduce:** Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.
**Cloud Application Design:** Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

**Module – 4** **08 Hours**

**Python for Cloud:** Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure.

**Module – 5** **08 Hours**

**Python for Cloud:** Python for MapReduce, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.
**Cloud Application Development in Python:** Design Approaches, Document Storage App, MapReduce App.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Outline the concepts and technologies of clouds.
2. Identify all the available cloud services
3. Analyze the design methodologies of cloud applications
4. Utilize suitable platforms for developing cloud applications
5. Develop cloud various applications using python

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Cloud Computing: A Hands on Approach | Arshdeep Bahga, Vijay Madisetti | ISBN/EAN13: 1494435144/9781494435141 | 2013 |
| **Reference Books** | | | | |
| 1 | Cloud Computing: A Practical Approach for Learning and Implementation | A. Srinivasan, J. Suresh | 1$^{st}$ Edition, Pearson Publications | 2014 |
| 2 | Explain the Cloud Like I'm 10 | Todd Hoff | | 2017 |

## Semester: VI
## Course Name: BLOCKCHAIN TECHNOLOGY

| | | | |
|---|---|---|---|
| Course Code | **21CS642** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic idea of networks
- Basic idea of cloud computing

**Course objectives:**
1. To describe the fundamentals of distributed computing and evaluate the role it plays in blockchain technology.
2. To examine the fundamentals of cryptography and assess how they affect blockchain technology.
3. To assess the advantages, disadvantages, and various uses of blockchain technology.
4. To become familiar with the technology used in Bitcoin
5. To demonstrate proficiency in utilizing the Ethereum platform to develop blockchain applications.

**Module – 1** **08 Hours**

**Blockchain 101:** Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.
**Decentralization and Cryptography:** Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

**Module - 2** **08 Hours**

**Introduction to Cryptography & Cryptocurrencies:** Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency.
**How Bitcoin Achieves Decentralization:** Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together

**Module – 3** **08 Hours**

**Mechanics of Bitcoin:** Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.
**How to Store and Use Bitcoins:** Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

**Module – 4** **08 Hours**

**Bitcoin Mining:** The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.
**Bitcoin and Anonymity:** Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash

**Module – 5** **08 Hours**

**Smart Contracts and Ethereum 101:** Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

**Course Outcomes:** The student should be able to
1. Interpret the principles of Distributed computing and analyze its significance in Blockchain technology.
2. Analyze the principles of Cryptography and evaluate its impact on Blockchain technology.
3. Evaluate the benefits, drawbacks, and diverse applications of Blockchain technology
4. Impart the technologies involved in Bitcoin
5. Utilize the Ethereum platform to develop blockchain applications

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained | Imran Bashir | Packt Publishing Ltd, Second Edition | 2017 |
| 2 | Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction | Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark | Princeton University Press | 2016 |
| **Reference Books** | | | | |
| 1 | Mastering Bitcoins: Unlocking Digital Cryptocurrencies | Andreas Antonopoulos | O'Reilly Media, Inc | 2013 |

## Semester: VI
## Course Name: NATURAL LANGUAGE PROCESSING

| | | | |
|---|---|---|---|
| Course Code | **21CS643** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of Python, Data Structures & Algorithms

**Course objectives:**
1. Introduce the fundamental techniques of natural language processing.
2. Analyze the natural language text.
3. Describe types of classifiers used for text classification.
4. Understand the concepts of Text mining.
5. Illustrate information retrieval techniques.

**Module – 1** **08 Hours**

**Introduction to NLP**
NLP in real world, NLP tasks, Language – Building Blocks of Language, NLP challenges, Machine Learning, Deep Learning and NLP overview, Approaches to NLP – Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP
NLP Pipeline
Generic NLP pipeline, Data Acquisition

**Module – 2** **08 Hours**

**NLP Pipeline**
Text Extraction and Clean up – Normalization, Spelling Correction, System Specific Error Correction, Preprocessing – Word Tokenization, Stemming and Lemmatization
**Text Representation**
Vector Space Model, Bag of words, N – gram, TF – IDF, Word Embedding's – Continuous bag of words (CBOW), Skip Gram.

**Module – 3** **08 Hours**

**Text Classification**
Naïve Bayes classifier, Logistic Regression, Support Vector Machine, CNNs and LSTMs for Text Classification, Case study – Corporate Ticketing

**Module – 4** **08 Hours**

**Information Extraction (IE)**
IE Applications, IE Tasks, Pipeline for IE, Key phrase Extraction, Named Entity Recognition (NER) – Building and NER system, NLP using Active Learning, Dis-ambiguity and Linking Relationship Extraction – Approaches to RE

**Module – 5** **08 Hours**

**Chat bots**
A simple FAQ chat bots, Taxonomy of chat bots – Goal oriented Dialog, Chit chats, Pipeline for building dialog systems, Components of Dialog system – Dialog Act classification, identifying slots, Response Generation, End – to – End approach, Deep Reinforcement Learning for Dialog Generation, Human – in – the – Loop.

**Course Outcomes:**
**The student will be able to-**

1. Apply hidden Markov models, and word embeddings to implement autocorrect, auto complete and identify part-of-speech tags for words.
2. Apply logistic regression and naïve Bayes to implement NLP applications that perform sentiment analysis.
3. Illustrate word vectors to complete analogies and translate words.
4. Demonstrate the concepts of neural networks, LSTM, GRUs for sentiment analysis, text generation and named entity recognition.
5. Design NLP applications that perform question-answering and create tools to translatelanguages and even build chat bots.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems | Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana | Oreilly | 1st Edition, 2020 |
| **Reference Books** | | | | |
| 1 | Natural Language Understanding | James Allen | Pearson Education | |
| 2 | Speech and Language Processing | Jurafsky Dan & Martin James H | Prentice Hall | 3rd Edition, 2023 |
| 3 | Natural Language Processing and Information Retrieval | Tanveer Siddiqui, U.S. Tiwary | Oxford University Press | 2008 |
| 4 | Natural Language Processing with Python | Steven Bird, Ewan Klein & Edward Loper | Oreilly Media | 1st Edition, 2009 |
| 5 | Foundations of Statistical Natural Language Processing | Christopher D Manning & HinrichSchutze | MIT Press | 1999 |
| | | Links | | |
| 1 | https://nptel.ac.in/courses/106/105/106105158/ | | | |
| 2 | http://www.nptelvideos.in/2012/11/natural-language-processing.html | | | |

**Semester: VI**
**Course Name: MACHINE LEARNING LAB**

| | | | |
|---|---|---|---|
| Course Code | **21AIL66** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course Objectives:**
1. To learn and understand the Machine Learning Algorithms
2. Implement and evaluate ML algorithms.
3. Compare and contrast the learning techniques ANN approach, Bayesian learning and reinforcement learning.
4. Able to solve and analyze the problems on ANN, Instance based learning and Reinforcement learning techniques.
5. To impart the knowledge of clustering and classification Algorithms for predictions and evaluating Hypothesis.

**List of Experiments:**

| SN | Experiments |
|---|---|
| 1 | Illustrate and Demonstrate the working model and principle of Find-S algorithm.<br>**Program:** For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples. |
| 2 | Demonstrate the working model and principle of candidate elimination algorithm.<br>**Program:** For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. |
| 3 | To construct the Decision tree using the training data sets under supervised learning concept.<br>**Program:** Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. |
| 4 | To understand the working principle of Artificial Neural network with feed forward and feed backward principle.<br>**Program:** Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets. |
| 5 | Demonstrate the text classifier using Naïve bayes classifier algorithm.<br>**Program:** Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. |
| 6 | Demonstrate and Analyse the results sets obtained from Bayesian belief network Principle.<br>**Program:** Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API. |
| 7 | Implement and demonstrate the working model of K-means clustering algorithm with Expectation Maximization Concept.<br>**Program:** Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML library classes/API in the program. |
| 8 | Demonstrate and analyse the results of classification based on KNN Algorithm.<br>**Program:** Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. |
| 9 | Understand and analyse the concept of Regression algorithm techniques.<br>**Program:** Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs. |
| 10 | Implement and demonstrate classification algorithm using Support vector machine Algorithm.<br>**Program:** Implement and demonstrate the working of SVM algorithm for classification. |

**Course outcomes:**

At the end of the course the student will be able to:

1. Implement different classification and clustering algorithms.
2. Demonstrate the working of various algorithms with respect to training and test data sets.
3. Illustrate and analyze the principles of Instance based and Reinforcement learning techniques.
4. Elicit the importance and Applications of Supervised and unsupervised machine learning.
5. Compare and contrast the Bayes theorem principles and Q learning approach.

## Semester: VI
## Course Name: MOBILE APPLICATION DEVELOPMENT LAB

| | | | |
|---|---|---|---|
| Course Code | **21AIL67** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course Objectives:**
1. Learn and acquire the art of Android Programming.
2. Configure Android studio to run the applications.
3. Understand and implement Android's User interface functions.
4. Create, modify and query on SQLite database.
5. Inspect different methods of sharing data using services.

**List of Experiments:**

**Part A**

**Identify the functional requirements, then Design Develop solutions to the problems related to:**
1. Create an application to design a Visiting Card
2. Develop an Android application to demonstrate simple calculator
3. Create a SIGN Up activity with Username and Password. Validation of password should happen based on set of rules
4. Develop an application to set an image as wallpaper
5. Develop an application to convert text to speech
6. Develop a counter application
7. Develop an application on phone contact

**Part B**

Part B programs should be developed as an application and be demonstrated as a mini project in a group by adding extra features or the students can also develop their own application and demonstrate it as a mini project. (Projects/programs are not limited to the list given in Part B)
1. Medical Application Database
2. Content provider Application
3. SMS Application
4. Media player Application
5. EMI Calculator

**Course outcomes:**
1. Create, test and debug Android application by setting up Android development environment.
2. Implement adaptive, responsive user interfaces that work across a wide range of devices.
3. Infer long running tasks and background work in Android applications.
4. Demonstrate methods in storing, sharing and retrieving data in Android applications.
5. Develop an application to model real world problems

**Semester: VI**
**Course Name: MINI PROJECT**

| | | | |
|---|---|---|---|
| Course Code | **21MN68** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:4** | SEE Marks | **50** |
| Credits | **0** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Mini-project work:** Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students

**CIE procedure for Mini-project:**

i. **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the **project report, project presentation skill, and question and answer session** in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates

ii. **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the **project report, project presentation skill, and question and answer session** in the ratio **50:25:25.** The marks awarded for the project report shall be the same for all the batch mates

## Semester: VI
## Course Name: COMPUTER GRAPHICS USING OPENGL

| | | | |
|---|---|---|---|
| Course Code | **21CS69A** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **3** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Pre-requisites:**
1. Basic operations of vectors and matrices.
2. Basic concepts of 2-D computer graphics.
3. Good programming skills in C or C++

**Course objectives:**
1. Apply the mathematical concepts and fundamentals of computer graphics to visualize objects in the computer
2. Examine the coordinate systems of computer graphics
3. Evaluate 2D, 3D transformation of objects
4. Determine process of plotting objects using graphics library toolkit
5. Interpret and animated solution to solve real world problems

**Design, develop, and implement the following programs using OpenGL API**
1. Implement different Geometrical Primitives using various types of Symbolic Constants in OpenGL
2. Implement Brenham's line drawing algorithm for all types of slope.
   Refer: Text-1: Chapter 3.5
   Refer: Text-2: Chapter 8
3. Create and rotate a triangle about the origin and a fixed point.
   Refer: Text-1: Chapter 5-4.
4. 3. Draw a color cube and spin it using OpenGL transformation matrices.
   Refer: Text-2: Modelling a Colored Cube.
5. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing.
   Refer: Text-2: Topic: Positioning of Camera.
6. Clip a lines using Cohen-Sutherland algorithm
   Refer: Text-1: Chapter 6.7
   Refer: Text-2: Chapter 8
7. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
   Refer: Text-2: Topic: Lighting and Shading
8. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user.
   Refer: Text-2: Topic: sierpinski gasket.
9. Develop a menu driven program to animate a flag using Bezier Curve algorithm
   Refer: Text-1: Chapter 8-10
10. Develop a menu driven program to fill the polygon using scan line algorithm
    Refer: Text-1: Chapter 2

**Course Outcomes**
1. Apply the concepts of computer graphics
2. Implement computer graphics applications using OpenGL
3. Implement real world problems using OpenGL

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer Graphics-OpenGL | Donald Hearn & Pauline Baker | Pearson Education | 2011 |
| 2 | OpenGL Programming Guide | Dave shreiner | Pearson Education | 2010 |
| **Reference Books** | | | | |
| 1 | Interactive computer graphics- A Top Down approach with OpenGL | Edward Angel | Pearson Education | 2011 |
| 2 | Computer Graphics using OpenGL Fillip Learning | M MRaikar | Elsevier | 2013 |

## Semester: VI
## Course Name: MOBILE APPLICATION DEVELOPMENT

| | | | |
|---|---|---|---|
| Course Code | **21CS69B** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P:S) | **1:0:0** | SEE Marks | **50** |
| Credits | **1** | Exam Hours | **2** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of JAVA programming

**Course objectives:**
1. To understand the architecture and components of android application
2. To design interactive user interface
3. To design interface using Specialized Fragments
4. To work with SQLite database
5. To develop an Android Application to solve real world problems

**Module – 1** **03 Hours**

Getting Started with Android Programming: Android, Features of Android, Android Architecture, obtaining the required tools, launching your first android application.

**Module - 2** **03 Hours**

Activities, Fragments and Intents: Understanding activities, linking activities using intents, fragments

**Module – 3** **03 Hours**

Getting to know the Android User Interface: Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView

**Module – 4** **03 Hours**

Designing User Interface with Views: TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews, ProgressBar View, AutoCompleteTextView View, TimePicker View, DatePickerView, ListView View, SpinnerView

**Module – 5** **03 Hours**

Understanding Specialized Fragments: List Fragment, DialogFragment, PreferenceFragment
Creating and using Databases: Creating the DBAdapter Helper class, using the database programmatically

**Course Outcomes:**
1. Understand various application components in android.
2. Design efficient user interface using different layouts.
3. Develop application using Specialized Fragments
4. Develop application with persistent data storage using SQLite
5. Develop an interactive applications using android studio

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Beginning Android Programming with Android Studio | J. F. DiMarzio | 4thEdition | 2017 |
| **Reference Books** | | | | |
| 1 | Android Programming for Beginners | John Horton | 1stEdition | 2015 |
| 2 | Head First Android Development | Dawn Griffiths & David Griffiths | O'Reilly, 1stEdition | 2015 |

## Semester: VI
## Course Name: ROBOTIC PROCESS AUTOMATION

| | | | |
|---|---|---|---|
| Course Code | **21CS69C** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **3** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:**
- Basic Programming Concepts

**Course objectives:**
At the end of the course, the student will be able to
1. Outline the basic concepts of RPA.
2. Understand the various components of RPA, where it can be applied and how it implemented
3. Describe the different types of variables, Control Flow and data manipulation techniques
4. Model the workflow of various control techniques and OCR in RPA
5. Interpret use of exception handling techniques to handle the log errors.

**Module – 1** **03 Hours**

**RPA Foundations:**
What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall DevOps- Flowcharts.

**Module - 2** **03 Hours**

**RPA Platforms:**
Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio - Task recorder - Step-by- step examples using the recorder.

**Module – 3** **03 Hours**

**Sequence, Flowchart, and Control Flow:**
Sequencing the workflow- Activities - Control flow, various types of loops, and decision making-Step-by- step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope- Collections-Arguments – Purpose and use-Data table usage with examples- Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).

**Module – 4** **03 Hours**

**Taking Control of the Controls:**
Finding and attaching windows- Finding the 08 control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.

**Module – 5** **03 Hours**

**Exception Handling:**
Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting.

**Course Outcomes:**
The student should be able to:
1. Discuss the fundamental & basic principles of Robotic Process Automation, Applications in various industries.
2. Summarize the various components & Platforms of RPA.
3. Analyze the different types of variables, control flow and data manipulation techniques.
4. Apply various control techniques and OCR in RPA
5. Design and develop a bot to capture runtime exception & handling of such type of exceptions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems | Tom Taulli | A press | 2020, ISBN-13 (electronic): 978-1-4842-5729-6 |
| 2 | Learning Robotic Process Automation | Alok Mani Tripathi | Packt Publishing | March 2018 ISBN: (electronic): 9781788470940 |
| **Reference Books** | | | | |
| 1 | Introduction to Robotic Process Automation: a Primer | Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston | Institute of Robotic Process Automation | |
| 2 | Richard Murdoch | Robotic Process Automation: Guide To Building Software Robots | Automate Repetitive Tasks & Become An RPA Consultant | |

## Semester: VI
## Course Name: PROGRAMMING IN JAVA

| | | | |
|---|---|---|---|
| Course Code | **21CS651** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Students should know the basic knowledge on:
- C Programming
- C++

**Course objectives:**
1. Learn fundamental features of object oriented language and JAVA.
2. To create, debug and run simple Java programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object Oriented concepts.

**Module – 1** **08 Hours**

**Introduction to Java:** Java's magic: The Bytecode, The Java Buzzwords.
**An Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Lexical Issues.
**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.

**Module - 2** **08 Hours**

**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.
**Control Statements:** Java's Selection Statements, Iteration Statements, Jump Statements.

**Module – 3** **08 Hours**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class.
**A Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

**Module – 4** **08 Hours**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces.
**Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

**Module – 5** **08 Hours**

**Enumerations:** Enumerations.
**I/O:** I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files, Automatically Closing a File.
**String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.

**Course Outcomes:**
1. Identify classes, objects, members of a class and relationship among them needed for a specific problem.
2. Develop JAVA application programs using control statements.
3. Implement reusability Programs in JAVA using inheritance.
4. Develop JAVA Programs of error handling techniques using exception handling.
5. Demonstrate string handling concepts using JAVA.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8th Edition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balagurusamy | Tata McGraw Hill | |

**Semester: VI**

**Course Name: INTRODUCTION TO DATA ANALYTICS**

| | | | |
|---|---|---|---|
| Course Code | **21CS652** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module - 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
Advanced data visualization- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools,and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

## Semester: VI
## Course Name: INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| | | | |
|---|---|---|---|
| Course Code | **21CS653** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of **Mathematics & Data Structures and Algorithms**

**Course objectives:**
1. Understands the basics of AI, history of AI and its foundations, basic principles of AI for problem solving.
2. Compare and contrast different AI techniques available.
3. Define and explain learning algorithms
4. Explore the basics of Machine Learning & Machine Learning process, understanding data
5. Understand the Working of Artificial Neural Networks.

**Module – 1** **08 Hours**

**Introduction:** What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents.

**Module - 2** **08 Hours**

**Problem solving by searching:** Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions

**Module – 3** **08 Hours**

**Introduction to machine learning:** Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process,Machine Learning applications.
**Understanding Data:** What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization.

**Module – 4** **08 Hours**

**Understanding Data:** Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,
**Basics of Learning Theory:** Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.
**Similarity-based learning:** Introduction to Similarity or instance based learning, Nearest-neighbour learning, weighted k- Nearest - Neighbour algorithm.

**Module – 5** **08 Hours**

**Artificial Neural Network:** Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Design intelligent agents for solving simple gaming problems.
2. Apply techniques to solve the AI problems
3. Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning
4. Understand data and applying machine learning algorithms to predict the outputs.
5. Model the neuron and Neural Network, and to analyze ANN learning and its applications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence A Modern Approach | Stuart Russel, Peter Norvig | Pearson Education | 3rd Edition, 2015 |
| 2 | Machine Learning | S. Sridhar, M Vijayalakshmi | Oxford | 2021 |
| **Reference Books** | | | | |
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3rd Edition, 2009 |
| 2 | Principles of Artificial Intelligence | Nils J. Nilsson | Elsevier | 1980 |

**Semester: VI**
**Course Name: INTRODUCTION TO CYBER SECURITY**

| | | | |
|---|---|---|---|
| Course Code | **21CS654** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:** The students should have the knowledge of:
- Awareness about the loopholes/drawbacks of the advanced technologies on which the society is dependent.
- Awareness about the crimes being done through technology.

**Course objectives:**
1. To familiarize the cybercrime terminologies and perspectives.
2. To illustrate the phases of cybercrime plan and different types of cybercrimes.
3. To gain the knowledge about the tools and methods used by the criminals.
4. To reveal the techniques used in phishing and identity theft.
5. To emphasize the necessary of computer and cyber forensics.

**Module – 1** **08 Hours**

**Introduction to Cybercrime:**
**Cybercrime:** Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**Module - 2** **08 Hours**

**Cyber Offenses:**
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber cafe & cybercrimes.
**Botnets:** The fuel for cybercrime, Attack Vector.

**Module – 3** **08 Hours**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

**Module – 4** **08 Hours**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

**Module – 5** **08 Hours**

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**Course Outcomes:**
1. Identify the various terminologies being used in cybercrime.
2. Categorize the types of cybercrimes.
3. Illustrate the tools and methods used by criminals for cybercrime.
4. Compare the various techniques used in phishing and identity theft.
5. Utilize various cyber security techniques including cyber forensics.

**Suggested Learning Resources:**

**Text Books:**
Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)
**Reference Books:**
Neil Daswani, Moudy Elbayadi Big Breaches: "Cyber-security Lessons for Everyone", Feb 2021

## Assessment Details (PCC)

**Continuous Internal Examination/ Evaluation (CIE)** :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The Alternate Assessment Tools are Assignments, Quiz and Seminar

**Semester End examination (SEE)**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

1. The question paper will have ten full questions carrying 20 marks each.
2. There will be two full questions (with a maximum of four sub questions) from each module.
3. The students will have to answer five full questions, selecting one full question from each module.

## Assessment Details (Laboratory)

**Continuous Internal Evaluation (CIE): 50 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | Total Marks | | 50 |

**Semester End Evaluation (SEE): 50 Marks**

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the questions lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. Marks distribution: procedure (15%)+ Execution (70%)+ viva voce (15%)

**Assessment Details (AEC)**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and are not limited to Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications, and other cooperative and problem-based learning.

**SEE:**

1. Theory SEE will be conducted with common question papers for subject
2. The pattern of the question paper is MCQ’s. The time allotted for SEE is 02 hours

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**

# Artificial Intelligence and Machine Learning (AI)

Scheme of Teaching and Examinations

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

**VII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18AI71 | Advanced Artificial Intelligence | CS / IS / AI | 4 | -- | -- | 03 | 40 | 60 | 100 | 4 |
| 2 | PCC | 18AI72 | Advanced Machine Learning | CS / IS / AI | 4 | -- | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PEC | 18AI73X | Professional Elective – 2 | CS / IS / AI | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PEC | 18AI74X | Professional Elective – 3 | CS / IS / AI | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | OEC | 18AI75X | Open Elective –B | CS / IS / AI | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18AIL76 | AI and ML Application Development Laboratory | CS / IS / AI | -- | -- | 2 | 03 | 40 | 60 | 100 | 1 |
| 7 | Project | 18AIP77 | Project Work Phase – 1 | CS / IS / AI | -- | -- | 2 | -- | 100 | -- | 100 | 2 |
| 8 | INT | -- | Internship | (If not completed during the vacation of VI and VII semesters, it has to be carried out during the intervening vacations of VII and VIII semesters | | | | | | | | |
| | | | | **TOTAL** | **17** | -- | **4** | **18** | **340** | **360** | **700** | **20** |

**Note: PCC: Professional core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.**

**Professional Elective – 2**

| **Course code under 18CS73X** | **Course Title** | | |
|---|---|---|---|
| 18AI731 | Internet of Things | 18AI733 | Blockchain Technology |
| 18AI732 | Multiagent Systems | 18AI734 | Cloud Computing and Virtualization |

**Professional Electives – 3**

| **Course code under 18CS74X** | **Course Title** | | |
|---|---|---|---|
| 18AI741 | Fuzzy Logic& its Applications | 18AI743 | Semantic Web and Social Network |
| 18AI742 | Computer Vision | 18AI744 | Business Intelligence |

**Open Elective –B** (18CS75x are not to be opted by CSE / ISE / AIML Programs)

| | |
|---|---|
| 18CS751 | Introduction to Big Data Analytics |
| 18CS752 | Python Application Programming |
| 18CS753 | Introduction to Artificial Intelligence |
| 18CS754 | Introduction to Dot Net framework for Application Development |

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18CS75X).
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.
- Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

**Project work:** Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

**CIE procedure for Project Work Phase - 1:**

**(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**Internship:** All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**

# Artificial Intelligence and Machine Learning (AI)

Scheme of Teaching and Examinations
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

**VIII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18AI81 | Neural Networks and Deep Learning | AM | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PEC | 18AI82X | Professional Elective – 4 | AM | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 3 | Project | 18AIP83 | Project Work Phase – 2 | AM | -- | -- | 2 | 03 | 40 | 60 | 100 | 8 |
| 4 | Seminar | 18AIS84 | Technical Seminar | AM | -- | -- | 2 | 03 | 100 | -- | 100 | 1 |
| 5 | INT | 18AII85 | Internship | (Completed during the intervening vacations of VI and VII semesters and /or VII and VIII semesters.) | | | | 03 | 40 | 60 | 100 | 3 |
| | | | | **TOTAL** | **06** | **--** | **4** | **15** | **260** | **240** | **500** | **18** |

**Note: PCC: Professional Core, PEC: Professional Elective, OEC: Open Elective, INT: Internship.**

**Professional Electives – 4**

| Course code under 18CS82X | Course Title |
|---|---|
| 18AI821 | System Modelling and Simulation |
| 18AI822 | Soft and Evolutionary Computing |
| 18AI823 | Robotic Process Automation Design and Development |
| 18AI824 | Modern Information Retrieval |

**Project Work CIE procedure for Project Work Phase - 2:**
**(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
**SEE for Project Work Phase - 2:**
**(i) Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.
**(ii) Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.
**Internship:** Those, who have not pursued /completed the internship shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements

AICTE activity Points: In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

**ADVANCED ARTIFICIAL INTLLIGENCE**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18AI71 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 4:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 3 Hrs |

**CREDITS –4**

**Course Learning Objectives:** This course will enable students to:

- Demonstrate the fundamentals of Intelligent Agents
- Illustrate the reasoning on Uncertain Knowledge
- Explore the explanation based learning in solving AI problems
- Demonstrate the applications of Rough sets and Evolutionary Computing algorithms

| **Module 1** | **Contact Hours** |
|---|---|
| **IntelligentAgents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents<br>**Problem Solving :**Game Paying<br>**T1: Chapter 2, Chapter 5 (2.1 to 2.4, 5.1 to 5.6)** | 10 |
| **Module 2** | |
| **Uncertain knowledge and Reasoning:**Quantifying Uncertainty**,** Acting under Uncertainty , Basic Probability Notation, Inference Using Full Joint Distributions, Independence , Bayes'Rule and Its Use The WumpusWorld Revisited,<br>**T1: Chapter 13** | 10 |
| **Module 3** | |
| **Probabilistic Reasoning,** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks , Efficient Representation of Conditional Distributions Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks.<br>**T1: Chapter 14** | 10 |
| **Module 4** | |
| **Perception**: Image Formation, Early Image-Processing Operation, Object Recognition by Appearance, Reconstructing the 3DWorld. Object Recognition from Structural Information, Using Vision<br>**T1: Chapter 24** | 10 |
| **Module 5** | |
| **Overview and language modeling:** Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.<br>**T2: Chapter 1, 2** | 10 |

**Course Outcomes:** The student will be able to :

- Demonstrate the fundamentals of Intelligent Agents
- Illustrate the reasoning on Uncrtain Knowledge

- Explore the explanation based learning in solving AI problems
- Demonstrate the applications of Rough sets and Evolutionary Computing algorithms

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Artificial Intelligence, A Modern Approach, Stuart J. Russell and Peter Norvig, Third Edition, Pearson, 2010
2. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

**Reference Books:**

1. An Introduction to Multi Agent Systems, Michael Wooldridge, Second Edition, John Wiley & Sons

| ADVANCED MACHINE LEARNING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Subject Code** | 18AI72 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 4:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 3 Hrs |
| **CREDITS –4** | | | |
| **Course Learning Objectives:** This course will enable students to: | | | |
| • Demonstrate the fundamentals of GDT<br>• Illustrate the use of KNN<br>• Explore the Text feature Engineering concepts with Applications<br>• Demonstrate the use of Ensemble Methods | | | |

| Module 1 | Contact Hours |
|---|---|
| **Advanced Machine Learning:**<br>Overview, Gradient Descent algorithm, Scikit-learn library for ML, Advanced Regression models, Advanced ML algorithms, KNN, ensemble methods.<br>**T2: Chapter 6 (upto 6.5.4)**<br>**Forecasting:**Overview, components, moving average, decomposing time series, auto-regressive Models.<br>**T2: Chapter: 8** | 10 |
| **Module 2** | |
| **Hidden Markov Model:**Introduction, Issues in HMM( Evalution, decoding, learning, classifier)<br>**T3: Chapter 12**<br><br>**CLUSTERING**<br>**Introduction,** Types of clustering, Partitioning methods of clustering (k-means, k-medoids), hierarchical methods<br>**T3: Chapter 13** | 10 |
| **Module 3** | |
| **Recommender System:**<br>Datasets, Association rules, Collaborative filtering, User-based similarity, item-based similarity, using surprise library, Matrix factorization<br>**Text Analytics:**<br>Overview, Sentiment Classification, Naïve Bayes model for sentiment classification, using TF-IDF vectorizer, Challenges of text analytics<br>**T2: Chapter 9 and** 10 | 10 |
| **Module 4** | |
| **Neural networks and genetic algorithms:**<br>Brief history and Evolution of Neural network, Biological neuron, Basics of ANN,Activation function, MP model.<br>**T3: Chapter 6**<br>Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Genetic Algorithms – Hypothesis Space Search – Genetic | 10 |

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|---|---|
| Programming – Models of Evolution and Learning.<br>**T1: Chapter 4 & 9** | |
| **Module 5** | |
| **Instant based learning and learning set of rules:**<br><br>Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning(review), locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning<br><br>**T1 :Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3** | 10 |

**Course Outcomes:** The student will be able to :

- Apply effectively ML algorithmsto solve real world problems.
- Apply Instant based techniques and derive effectively learning rules to real world problems.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

T1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013

T2. Machine Learning using Python ,Manaranjan Pradhan, U Dinesh Kumar, Wiley 2019

T3. Machine Learning, Anuradha Srinivasaraghavan, VincyJoeph, Wiley 2019

**Reference Books:**

1. EthemAlpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2$^{nd}$ Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

| INTERNET OF THINGS<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Subject Code** | 18AI731 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course will enable students to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.

| **Module 1** | **Contact Hours** |
|---|---|
| What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.<br>**Textbook 1: Ch.1, 2**<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.<br>**Textbook 1: Ch.3, 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.<br>**Textbook 1: Ch.5, 6**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment<br>**Textbook 1: Ch.7, 8**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| IoT Physical Devices and Endpoints – Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints –RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, | 08 |

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|---|---|
| Smart City Use-Case Examples.<br>**Textbook 1: Ch.12**<br>**Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6**<br>**RBT: L1, L2, L3** | |

**Course Outcomes:** The student will be able to :

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1stEdition, Pearson Education (Cisco Press Indian Reprint). (**ISBN:** 978-9386873743)
2. Srinivasa K G, **"Internet of Things",**CENGAGE Leaning India, 2017

**Reference Books:**

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1stEdition, VPT, 2014. (**ISBN:** 978-8173719547)
2. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224)

**Mandatory Note:**
Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

**Maintain a copy of the report for verification during LIC visit.**

**Posssible list of practicals:**

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

**MULTIAGENT SYSTEMS**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

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|---|---|---|---|
| **Subject Code** | 18AI732 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |

**CREDITS – 03**

**Course Learning Objectives:** This course will enable students to:

- To introduce the concept of amultiagent systems and Distributed Constraints
- To explore the main issues surrounding the 93omputer and extended form games.
- To understand learning in Multiagent Systems
- To introduce a contemporary platform for implementing agents and multiagent systems.

| **Module – 1** | **Contact Hours** |
|---|---|
| **Multiagent Problem Formulation**: Utility, Markov Decision Processes, Planning<br>**Distributed Constraints**:Distributed Constraint Satisfaction, Distributed Constraint Optimization<br>**T1: Chapters 1 &2, T2: Chapter 1** | 08 |
| **Module – 2** | |
| **Standard and Extended Form Games**: Games in Normal Form, Games in Extended Form, Self-interested agents, Characteristic Form Games, Coalition Formation<br>**T1: Chapters 3&4, T2: Chapter 3** | 08 |
| **Module – 3** | |
| **Learning in Multiagent Systems**: The Machine Learning Problem, Cooperative Learning, Repeated Games, Stochastic Games, General Theories for Learning Agents, Collective Intelligence<br>**T1: Chapters 5** | 08 |
| **Module – 4** | |
| **Negotiation:**The Bargaining Problem, Monotonic Concession Protocol, Negotiation as Distributed Search, Ad-hoc Negotiation Strategies, The Task Allocation Problem.<br>**Protocols for Multiagent Resource Allocation: Auctions:** Simple Auctions,Combinatorial Auctions<br>**T1: Chapters 6&7,**<br>**T2: Chapter 11** | 08 |
| **Module – 5** | |
| **Voting and Mechanism Design**: The Voting Problem, Mechanism Design. **Nature-Inspired Approaches:**Ants and Termites, Immune System<br>**T1: Chapters 8&10,**<br>**T2: Chapter 10** | 08 |

**Course outcomes:** The students should be able to:

- Explain the concept of anmulti-agent systems and Distributed Constraints
- Explore the applications of 93omputer and extended form games.
- Understand learning in Multiagent Systems
- Introduce a contemporary platform for implementing agents and multi-agent systems.

**Question Paper Pattern:**

- The question paper will have ten questions.

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Fundamentals of Multiagent Systems by Jos´e M. Vidal, 2006, available online http://jmvidal.cse.sc.edu/papers/mas.pdf
2. Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, By YoavShoham, Kevin Leyton-Brown, Cambridge University Press, 2008, 2nd edhttp://www.masfoundations.org/mas.pdf

**Reference Books:**

1. Multiagent Systems : A Modern Approach to Distributed Artificial IntelligenceGerhard Weiss The MIT Press 2000

**BLOCKCHAIN TECHNOLOGY**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18AI733 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |

**CREDITS – 03**

**Course Learning Objectives:** This course will enable students to:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Decribe the models of blockchain
- Analyze and demonstrate the Ethereum

| **Module – 1** | **Contact Hours** |
|---|---|
| Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.<br><br>**Text Book 1: Chapter 1** | 08 |
| **Module-2** | |
| Decentralization and Cryptography:<br>Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.<br>Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys<br><br>**Text Book 1: Chapter 2,Chapter 4** | 08 |
| **Module-3** | |
| Bitcoin and Alternative Coins<br>A: Bitcoin, Transactions, Blockchain, Bitcoin payments<br>B: Alternative Coins<br>Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash<br><br>**Text Book 1: Chapter 3, Chapter 6, Chapter 8** | 08 |
| **Module-4** | |
| Smart Contracts and Ethereum 101:<br>Smart Contracts: Definition, Ricardian contracts.<br>Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.<br><br>**Text Book 1: Chapter 10** | 08 |
| **Module-5** | |
| Alternative Blockchains: Blockchains<br>Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, | 08 |

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|---|---|
| Media<br><br>**Text Book 1: Chapter 17** | |

**Course outcomes:** The students should be able to:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Decribe the models of blockchain
- Analyze and demonstrate the Ethereum
- Analyze and demonstrate Hyperledger fabric

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbook:**

1.**Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017**

**Reference Books:**

1. Blockchain Technology (Concepts and applications), Kumar saurabh, Ashutosh saxena, Wiley, 2020
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten,2016
3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017
4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

| CLOUD COMPUTING AND VIRTUALIZATION<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Subject Code** | 18AI734 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course will enable students to:

- Interpret the data in the context of cloud computing.
- Identify an appropriate method to analyze the data in cloud enviornmnet
- Understanding of virtalization concept

| **Module – 1** | **Contact Hours** |
|---|---|
| Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, Exercises and problems.<br><br>**Textbook 1: Chapter 1 ( 1.3-1.6), Chapter 3 (3.1-3.5, 3.7,3.8)**<br><br>RBT: L1, L2 | 08 |
| **Module – 2** | |
| Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GreThe Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.<br><br>**Textbook 1: Chapter 4 (4.1-4.11)**<br><br>RBT:L1,L2 | 08 |
| **Module – 3** | |
| Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems | 08 |

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| **Textbook 1: Chapter 5 (5.1-5.9, 5.11,5.12,5.16)**<br><br>RBT:L1,L2 | |
| **Module – 4** | |
| Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.<br><br>**Textbook1: Chapter 6 (6.1-6.14, 6.16)**<br><br>RBT : L1, L2, L3 | 08 |
| **Module – 5** | |
| Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to useS3 in java<br><br>**Textbook1: Chapter 9** (9.1-9.9, 11.1-11.5)<br><br>RBT: L1, L2, L3 | 08 |
| **Course outcomes:** The students should be able to: | |
| • Understand the concepts of cloud computing, virtualization and classify services of cloud computing<br>• Illustrate architecture and programming in cloud<br>• Define the platforms for development of cloud applications and List the application of cloud. | |
| **Question Paper Pattern:** | |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks<br>• There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module. | |

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| • The students will have to answer 5 full questions, selecting one full question from each module. |
| **Text Books:** |
| 1. Cloud Computing Theory and Practice, Dan C. Marinescu, Morgan Kaufmann, Elsevier 2013. |
| **Reference Books:** |
| 1. Mastering Cloud Computing Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi McGraw Hill Education |

| **FUZZY LOGIC AND ITS APPLICATION**<br>**(Effective from the academic year 2018 -2019)**<br>**SEMESTER – VII** | | | |
|---|---|---|---|
| **Subject Code** | 18AI741 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS – 03** | | | |

**Course Learning Objectives:** This course will enable students to:

- Define crisp set and fuzzy set theory.
- Identify the requirements to make calculation of fuzzy set theory.
- Describe fuzzy arithmetic principles.
- Explain fuzzy rules based systems.
- Apply fuzzy graphical techniques to draw inference over the computing problems.

| **Module – 1** | **Contact Hours** |
|---|---|
| **Introduction:** Historical perspective, utility of fuzzy systems, limitations of fuzzy systems, statistics andrandom processes, uncertainty in information, fuzzy sets and membership, chance versus fuzziness, sets aspoints in Hypercube.**Classical Sets and Fuzzy Sets:** classical sets, operations on them, mapping of classical sets to functions, fuzzysets, fuzzy set operations, properties of fuzzy sets, non-interactive fuzzy sets.<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| **Classical Relations and Fuzzy Relations:** Cartesian Product, Crisp Relations – Cardinality of Crisp Relations,Operations on Crisp Relations, and Properties of Crisp Relations, Composition. Fuzzy Relations –Cardinalityof Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Productand Composition, Non-interactive Fuzzy Sets.<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| **Membership Functions:** Features of the Membership Function, Standard Forms and Boundaries,Fuzzification, defuzzification to crisp sets, Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations,DefuzzificationMethods.Development of membership Functions: Membership value assignments<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| **Fuzzy Arithmetic and the Extension Principle** : Crisp Functions, Mapping and Relations, | 08 |

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| Functions of fuzzySets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations. Fuzzy Numbers IntervalAnalysis in Arithmetic, Approximate Methods of Extension – Vertex method, DSW Algorithm, RestrictedDSW Algorithm, Comparisons. Fuzzy Vectors.<br>**RBT: L1, L2** | |
| **Module – 5** | |
| **Fuzzy Rule Based Systems:** Natural Language, Linguistic Hedges, Rule-Based Systems – Canonical RuleForms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules.Graphical Techniques of Inference.<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Provide basic elements of fuzzy sets.
- Differentiate between fuzzy set and classical set theory.
- Apply fuzzy membership functions to solve value assignment problems.
- Explain approximate methods of fuzzy arithmetic and extension principle.
- Discuss the applications of fuzzy rule based systems.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Fuzzy Logic with EngineeringApplicationsTimothy J. Ross Wiley IndiaInternational edition,2010 reprint

**Reference Books:**

1. Fuzzy Logic- Intelligence,Control, and informationJohnYenRezaLangariPearson Education 1st Edition, 2004
2. Fuzzy Sets and Fuzzy Logic-Theory and ApplicationsGeorge J. KlirBoYuanPrentice Hall of India 1st Edition, 2000
3. Fuzzy Mathematical approach to pattern Recognition, S K Pal, and D Dutta majumder , John wiley 1986
4. Neuro-fuzzy pattern recognition: methods in Soft computing, S K Pal and S Mitra
5. Fuzzy set theory and its applications by H J Zimmermann, Springer Publications

## COMPUTER VISION
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18AI742 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |

**CREDITS – 03**

**Course Learning Objectives:** This course will enable students to:

- Learn basic principles of image formation, image processing algorithms and different

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|---|---|
| algorithms for recognition from single or multiple images (video).<br>• Understand the core vision tasks of scene understanding and recognition.<br>• Applications to 3D modelling, video analysis, video surveillance, object recognition | |
| **Module – 1** | **Contact Hours** |
| **Introduction and Image Formation:** What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration<br><br>**T1: Chap 1-1.1 & 1.2, Chap 2-2.1 to 2.3. T2:Chap 1-1.1 to 1.3** | 08 |
| **Module – 2** | |
| **Early Vision – One Image**: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Local Image Features, Texture<br><br>**T2:Chap 4-4.1 to 4.5, Chap5-5.1 to 5.5, Chap6-6.1 to 6.3, 6.5** | 08 |
| **Module – 3** | |
| **Early Vision – Multiple Images:** Stereopsis and Structure from Motion<br><br>**T2:Chap7-7.1 to 7.7, Chap 8-8.1 to 8.3** | 08 |
| **Module – 4** | |
| **Mid-level Vision**: Segmentation by Clustering, Grouping and Model fitting, Tracking<br><br>**T2:Chap9-9.1 to 9.4, Chap 10-10.1 to 10.7, Chap 11-11.1 to 11.3** | 08 |
| **Module – 5** | |
| **High-level Vision:** Registration, Smooth Surface and their Outlines, Range Data Detecting Objects in Images, Recognition<br><br>**T2:Chap12-12.1 to 12.3, Chap 13-13.1 to 13.3, Chap 14-14.1 to 14.4, Chap 17-17.1 to 17.3. T1:Chap 6-6.1 to 6.6** | 08 |
| **Course outcomes:** The students should be able to: | |
| • Implement fundamental image processing techniques required for computer vision<br>• Understand Image formation process<br>• Perform shape analysis<br>• Develop applications using computer vision techniques<br>• Understand video processing and motion computation | |
| **Question Paper Pattern:** | |
| • The question paper will have ten questions. | |

- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer, 2nd edition, 2020, http://szeliski.org/Book/
2. Computer Vision – A modern approach, by D. Forsyth and J. Ponce, Prentice Hall, 2nd edition, 2012

**Reference Books:**

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University, Press, 2012
5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
6. Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in OpencvAndTensorflow With Python, Shamshad Ansari, Apress, 2020

## SEMANTIC WEB AND SOCIAL NETWORKS

**(Effective from the academic year 2018 -2019)**

**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18AI743 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |

**CREDITS – 03**

**Course Learning Objectives:** This course will enable students to:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

| **Module – 1** | **Contact Hours** |
|---|---|
| Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide. Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map,Logic on the semantic Web.<br><br>**T1: Chapter 1,3,4** | 08 |

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|---|---|
| **RBT: L1, L2** | |
| **Module – 2** | |
| Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.<br><br>**T1: Chapter 2,5**<br><br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools,Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic,Rule and Inference Engines.<br><br>**T1: Chapter 7,8**<br><br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| Semantic Web Applications, Services and Technology: Semantic Web applications and services,Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services,Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods<br><br>**T1: Chapter 10,11,12**<br><br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Social Network Analysis and semantic web. What is social Networks analysis, development of the social networks analysis, Electronic Sources forNetwork Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.<br><br>**T2: Chapter 2,3**<br><br>**RBT: L1, L2** | 08 |
| **Course outcomes:** The students should be able to: | |
| • Work on the internal components of the social network.<br>• Model and visualize the social network.<br>• Analyse the behaviour of the users in the social network.<br>• Predict the possible next outcome of the social network.<br>• Apply social network in real time applications. | |
| **Question Paper Pattern:** | |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks | |

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

**Reference Books:**

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen,Springer Publications.
4. Programming the Semantic Web, T. Segaran, C.Evans, J. Taylor, O'Reilly, SPD.

| BUSINESS INTELLIGENCE<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Subject Code** | 18AI744 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS – 03** | | | |

**Course Learning Objectives:** This course will enable students to:

- Explain the Decision Support systems and Business Intelligence framework.
- Illustrate the significance of computerized Decision Support, and understand the mathematicalmodelling behind decision support.
- Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.Explore knowledge management, explain its activities, approaches and its implementation.
- Describe the Expert systems , areas suitable for application of experts system

| Module – 1 | Contact Hours |
|---|---|
| **Decision Support and Business Intelligence:** Opening Vignette, Changing Business Environments andComputerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, AnEarly Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), Aframework for Business Intelligence (BI), A Work System View of Decision Support.<br>**Text Book 1: Chapter 1**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| **Computerised Decision Support:** Decision Making, Models, Phases of the Decision-Making Process, TheIntelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions AreSupported.**Modelling and Analysis:**Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, andRisk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, andGoal Seeking<br><br>**Text Book 1: Chapter 2**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| **Data Warehousing:** Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, DataWarehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes.<br><br>**Text Book 1: Chapter 5**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| **Knowledge Management:** Introduction to Knowledge Management, Organizational Learning andTransformation, Knowledge Management Activities, Approaches to Knowledge Management, InformationTechnology (IT) In Knowledge Management, Knowledge Management Systems Implementation.<br><br>**Text Book 1: Chapter 11**<br>**RBT: L1, L2** | 08 |

| Module – 5 | |
|---|---|
| **Expert Systems:** Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of ExpertSystems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems,Benefits, Limitations, and Critical Success Factors of Expert Systems.<br><br>**Text Book 1: Chapter 12**<br><br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework.
- Describe the significance of 106omputerized Decision Support, apply the basics of mathematics to understand the mathematical modelling behind decision support.
- Explain Data warehousing , its architecture and Extraction, Transformation, and Load (ETL) Processes.
- Analyze the importance of knowledge management and explain its activities, approaches and its implementation.
- Describe the Expert systems and analyze its development , discuss areas suitable forapplication of experts system.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Business Intelligence and Analytics: Systems for decision support, RameshSharda,DursunDelden, Efraim Turban, Pearson Tenth edition

**Reference Books:**

1. Data Mining Techniques. ForMarketing, Sales and CustomerRelationshipManagementBerry M.&Linoff G. Wiley Publishing Inc 2004
2. Data Science for Business, Foster Provost and Tom Fawcett, O’Reilly Media,Inc2013

## INTRODUCTION TO BIG DATA ANALYTICS
## (OPEN ELECTIVE)
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18CS751 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |

**CREDITS –3**

**Course Learning Objectives:** This course will enable students to:

- Interpret the data in the context of the business.
- Identify an appropriate method to analyze the data
- Show analytical model of a system

| Module – 1 | Contact Hours |
|---|---|
| **Introduction to Data Analytics and Decision Making**: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step ModelingProcess.**Describing the Distribution of a Single Variable**:Introduction,Basic Concepts, Populations and Samples, Data Sets,Variables,and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools,Charts for Numerical Variables, Time Series Data, Outliers and Missing Values,Outliers,Missing Values, Excel Tables for Filtering,Sorting,and Summarizing.<br>**Finding Relationships among Variables**: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables.<br>**Textbook 1: Ch. 1,2,3**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 2** | |
| **Probability and Probability Distributions**:Introduction,Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Subjective Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation.<br>**Normal,Binormal,Poisson,and Exponential Distributions**:Introduction,The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density,Standardizing:Z-Values,Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution.<br>**Textbook 1: Ch. 4,5**<br>**RBT: L1, L2, L3** | 08 |

| Module – 3 | |
|---|---|
| **Decision Making under Uncertainty**:Introduction,Elements of Decision Analysis, Payoff Tables, Possible Decision Criteria, Expected Monetary Value(EMY),Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In,Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility Maximization Used?<br>**Sampling and Sampling Distributions**: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling.<br>**Textbook 1: Ch. 6,7**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 4** | |
| **Confidence Interval Estimation**: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters.<br>**Hypothesis Testing**:Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence.<br>**Textbook 1: Ch. 8,9**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 5** | |
| **Regression Analysis**: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit.<br>**Regression Analysis**: Statistical Inference:Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction.<br>**Textbook 1: Ch. 10,11**<br>**RBT: L1, L2, L3** | 08 |

| **Course outcomes:** The students should be able to: |
| --- |
| • Explain the importance of data and data analysis<br>• Interpret the probabilistic models for data<br>• Define hypothesis, uncertainty principle<br>• Evaluate regression analysis |
| **Question Paper Pattern:** |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks<br>• There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module. |
| |
| **Text Books:** |
| 1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cenage Learning |
| **Reference Books:** |
| 1. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577<br>2. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966 |

**PYTHON APPLICATION PROGRAMMING**
**(OPEN ELECTIVE)**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18CS752 | **IA Marks** | 40 |
| **Number of Lecture Hours/Week** | 3:0:0 | **Exam Marks** | 60 |
| **Total Number of Lecture Hours** | 40 | **Exam Hours** | 03 |

**CREDITS – 03**

**Course Objectives:**This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

| **Module – 1** | **Contact Hours** |
|---|---|
| Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions<br>**Textbook 1: Chapters 1 – 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 2** | |
| Iteration, Strings, Files<br>**Textbook 1: Chapters 5– 7**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 3** | |
| Lists, Dictionaries, Tuples, Regular Expressions<br>**Textbook 1: Chapters 8 – 11**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 4** | |
| Classes and objects, Classes and functions, Classes and methods<br>**Textbook 2: Chapters 15 – 17**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 5** | |
| Networked programs, Using Web Services, Using databases and SQL<br>**Textbook 1: Chapters 12– 13, 15**<br>**RBT: L1, L2, L3** | 08 |

**Course Outcomes:**After studying this course, students will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

| **Question paper pattern:** |
|---|
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks<br>• There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module. |
| **Text Books:** |
| 1. Charles R. Severance, **"Python for Everybody: Exploring Data Using Python 3",** 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf )<br>2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links) |
| **Reference Books:** |
| 1. Charles Dierbach, **"Introduction to Computer Science Using Python",**1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014<br>2. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372<br>3. Mark Lutz, **"Programming Python",**4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873<br>4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, **"Data Structures and Algorithms in Python",**1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176<br>5. ReemaThareja, **"Python Programming Using Problem Solving Approach",** Oxford university press, 2017. ISBN-13: 978-0199480173 |

| **INTRODUCTION TO ARTIFICIAL INTELLIGENCE**<br>**(OPEN ELECTIVE)**<br>**(Effective from the academic year 2018 -2019)**<br>**SEMESTER – VII** | | | |
|---|---|---|---|
| **Subject Code** | 18CS753 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS –3** | | | |
| **Course Learning Objectives:**This course will enable students to: | | | |
| • Identify the problems where AI is required and the different methods available<br>• Compare and contrast different AI techniques available.<br>• Define and explain learning algorithms | | | |

| **Module – 1** | **ContactHours** |
|---|---|
| What is artificial intelligence?, Problems, Problem Spaces and search<br>**TextBook1: Ch 1, 2**<br>**RBT: L1, L2** | 08 |

| | |
|---|---|
| **Module – 2** | |
| Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules,<br>**TextBoook1: Ch 4, 5 and 6.**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Symbolic Reasoning under Uncertainty, Statistical reasoning<br>**TextBoook1: Ch 7, 8**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| Game Playing, Natural Language Processing<br>**TextBoook1: Ch 12 and 15**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Learning, Expert Systems.<br>**TextBook1: Ch 17 and 20**<br>**RBT: L1, L2** | 08 |
| **Course outcomes:** The students should be able to: | |
| • Identify the AI based problems<br>• Apply techniques to solve the AI problems<br>• Define learning and explain various learning techniques<br>• Discuss on expert systems | |
| **Question paper pattern:** | |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks<br>• There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module. | |
| **Text Books:** | |
| 1. E. Rich , K. Knight & S. B. Nair – Artificial Intelligence, 3/e, McGraw Hill. | |
| **Reference Books:** | |
| 1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.<br>2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.<br>3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem Solving”, Fourth Edition, Pearson Education, 2002.<br>4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.<br>5. N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford University Press-2015 | |

| INTRODUCTION TO DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT<br>(OPEN ELECTIVE)<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Subject Code** | 18CS754 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course will enable students to:

- Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
- Understand Object Oriented Programming concepts in C# programming language.
- Interpret Interfaces and define custom interfaces for application.
- Build custom collections and generics in C#
- Construct events and query data using query expressions

| Module – 1 | Contact Hours |
|---|---|
| **Introducing Microsoft Visual C# and Microsoft Visual Studio 2015:** Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions<br>**T1: Chapter 1 – Chapter 6**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| **Understanding the C# object model:** Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays<br>**Textbook 1: Ch 7 to 10**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management<br>**Textbook 1: Ch 11 to 14**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| **Defining Extensible Types with C#:** Implementing properties to access fields, Using indexers, Introducing generics, Using collections<br>**Textbook 1: Ch 15 to 18**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading<br>**Textbook 1: Ch 19 to 22**<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Build applications on Visual Studio .NET platform by understanding the syntax and semantics of

| |
|---|
| C#<br>• Demonstrate Object Oriented Programming concepts in C# programming language<br>• Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.<br>• Illustrate the use of generics and collections in C#<br>• Compose queries to query in-memory data and define own operator behaviour |
| **Question paper pattern:** |
| The question paper will have TEN questions.<br>There will be TWO questions from each module.<br>Each question will have questions covering all the topics under a module.<br>The students will have to answer FIVE full questions, selecting ONE full question from each module. |
| **Text Books:** |
| 1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016 |
| **Reference Books:** |
| 1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.<br>2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.<br>3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012. |

| **AI AND ML APPLICATION DEVELOPMENT LABORATORY**<br>**(Effective from the academic year 2018 -2019)**<br>**SEMESTER – VII** | | | |
|---|---|---|---|
| **Subject Code** | 18AIL76 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 0:2:2 | **SEE Marks** | 60 |
| **Total Number of Lab Contact Hours** | | **Exam Hours** | 3 Hrs |
| **Credits – 2** | | | |
| **Course Learning Objectives:** This course will enable students to: | | | |
| • Explore the knowledge of AI and ML concepts and practice to groom students into well-informed application developers.<br>• Demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering for designing intelligent systems<br>• Apply computational knowledge and project development skills to provide innovative solutions.<br>• Strong practice in AI and ML programming through a variety of AI and ML problems.<br>• Develop AI and ML applications using front-end and back-end tools | | | |
| **Descriptions (if any):** 1. The programs can be implemented in either JAVA or Python.<br>2. Data sets can be taken from standard repository | | | |

| |
|---|
| **Part A** |
| 1. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. |
| 2. Develop a program to apply K-means algorithm to cluster a set of data stored in .CSV file. Use the same data set for clustering using **EM algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. |
| 3. Implement the non-parametric **Locally Weighted Regressionalgorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs |
| 4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets |
| 5. Demonstrate **Genetic algorithm** by taking a suitable data for any simple application. |
| 6. Demonstrate **Q learning** algorithm with suitable assumption for a problem statement. |
| **PART B**<br><br>**Mini Project**<br>• Use Java, C#, PHP, Python, or any other similar front-end tool. Developed mini projectns must be demonstrated on desktop/laptop as a stand-alone or web based application<br>• Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.<br>• Indicative areas include: health care, education, agriculture, banking, library, agent based systems, registration systems, industry, reservation systems, facility management, super market etc.,Similar to but not limited to:<br>Handwritten Digit Recognition<br>Prediction of Cardiac Arrhythmia type using Clustering and Regression Approach<br>Hybrid Regression Technique for House Prices Prediction<br>An Iris Recognition Algorithm for Identity Authentication<br>An Approach to Maintain Attendance using Image Processing Techniques<br>Unconstrained Face Recognition<br>Vehicle Number Plate Detection System<br>Detection of Fake News<br>Stock Prediction using Linear Regression<br>Prediction of Weather Report<br>Analyzing Bike Sharing Trends<br>Sentiment Analysis for Movie Reviews<br>Analyzing and Recommendations of Music Trends<br>Forecasting Stock and Commodity Prices<br>Diabetes Prediction<br>Speech Recognition<br>Spam Detection using neural Networks in Python<br>Combining satellite imagery and to predict poverty |
| **Conduct of Practical Examination:** |
| • Experiment distribution |

- For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
- For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Subjected to change in accordance with university regulations)*
  s) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  t) For laboratories having PART A and PART B
     i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
     ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

**NEURAL NETWORKS AND DEEP LEARNING**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VIII**

| | | | |
|---|---|---|---|
| **Subject Code** | 18AI81 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |

**CREDITS – 03**

**Course Learning Objectives:** This course will enable students to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

| Module – 1 | Contact Hours |
|---|---|
| **Introduction to ANN:** Biological to Artificial neuron, Training an MLP, Training a DNN with TensorFlow , Fine tuning NN HyperParametersUp and Running with TensorFlow **Chapter 9 and 10** | 08 |
| **Module-2** | |
| **Deep Neural network:** Introduction, Vanishing Gradient problems, Reusing Pretrained layers, Faster optimizers, avoiding over fitting through regularization **Chapter 11** | 08 |
| **Module-3** | |
| **Distributing Tensor flow across devices and servers**: Multiple devices on a single machine, multiple servers, parallelizing NN on a Tensor Flow cluster **Convolution Neural Network**: Architecture of the visual cortex, Convolutional layer, Pooling layer, CNN architecture | 08 |

| | |
|---|---|
| **Chapter 12 and 13** | |
| **Module-4** | |
| **Recurrent Neural Network**: Recurrent neurons, Basic RNN in Tensor Flow, Training<br>RNN , Deep RNNs, LSTM Cell, GRU Cell, NLP<br>**Chapter 14** | 08 |
| **Module-5** | |
| **Autoencoders:** Efficient data representation, Performing PCA, Stacked autoencoders, Unsupervised pretraining using SA, Denoising, Sparse autoencoders, variational and other autoencoders.<br>**Reinforcement Learning:** Learning to optimize rewards, policy search, Introduction to OpenAI Gym, Neural network polices, Evaluating actions, Policy gradients, Markov decision processes, TDL and Q-learning, Learning to play Ms.Pac-man using Deep Q Learning<br>**Chapter 15 and 16** | 08 |

**Course outcomes:** The students should be able to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Hands on Machine Learning with Scikit-Learn &TensorFlow, AurelienGeron, O'Reilly, 2019

**Reference Books:**


1. Deep Learning Lan Good fellow and YoshuaBengio and Aaron CourvilleMIT Press2016.
2. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer International Publishing, 2018

| SYSTEM MODELLING AND SIMULATION<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Subject Code** | 18AI821 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course will enable students to:

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

| Module 1 | Contact Hours |
|---|---|
| **Introduction:** When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles.**<br>**Textbook 1: Ch. 1, 2, 3.1.1, 3.1.3**<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| **Statistical Models in Simulation** :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions.<br>**Queuing Models:**Characteristics of queuing systems,Queuingnotation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont…,Steady-state behavior of M/G/1 queue, Networks of queues,<br>**Textbook 1: Ch. 5,6.1 to 6.3, 6.4.1,6.6**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| **Random-NumberGeneration:**Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique.<br>**Textbook 1: Ch. 7,8.1, 8.2**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| **Input Modeling:** Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.<br>**Estimation of Absolute Performance:** Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation,<br>**Textbook 1: Ch. 9, 11.1 to 11.3**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| Measures of performance and their estimation,Output analysis for terminating simulations Continued..,Output analysis for steady-state simulations.<br>**Verification, Calibration And Validation:** Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models,Calibration and validation of models, Optimization via Simulation. | 08 |

| | |
|---|---|
| **Textbook 1: Ch. 11.4, 11.5, 10**<br>**RBT: L1, L2, L3** | |

**Course Outcomes:** The student will be able to :

- Explain the system concept and apply functional modeling method to model the activities of a static system
- Describe the behavior of a dynamic system and create an analogous model for a dynamic system;
- Simulate the operation of a dynamic system and make improvement according to the simulation results.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

**Reference Books:**

1. Lawrence M.Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007

| SOFT AND EVOLUTIONARY COMPUTING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Subject Code** | 18AI822 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS – 03** | | | |

**Course Learning Objectives:** This course will enable students to:

- Describe the basics of Soft computing
- Explain the process Fuzzy &Genetic Algorithm to solve the optimization problem.
- Analyse the Neuro Fuzzy system for clustering and classification.
- Illustrate the process of swarm intelligence system to solve real world problems.

| **Module – 1** | **Contact Hours** |
|---|---|
| **Introduction to Soft computing:** Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications.<br><br>**Introduction to classical sets and fuzzy sets:** Classical relations and fuzzy relations, Membership functions.<br>**T1: Chapter 1 and 7& 8** | 08 |
| **Module – 2** | |
| Fuzzification and Defuzzification<br>**T1: Chapter 9 & 10** | 08 |
| **Module – 3** | |
| **Genetic algorithms**: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, Operators, Stopping conditions for GA flow.<br>**T1: Chapter 15.1 To 15.10**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| **Swarm Intelligence System:** Introduction, background of SI, Ant colony system<br><br>Working of ant colony optimization, ant colony for TSP.<br><br>**T2: 8.1 to 8.5**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Unit commitment problem, particle Swarm Intelligence system<br><br>Artificial bee colony system, Cuckoo search system.<br><br>**T2: 8.6 to 8.9**<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Implement machine learning through neural networks.
- Design Genetic Algorithm to solve the optimization problem.
- Develop a Fuzzy expert system.

- Model Neuro Fuzzy system for clustering and classification

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, 2011/Reprint2014
2. Soft Computing with MATLAB Programming, N. P. Padhy, S.P. Simon, Oxford, 2015.

**Reference Books:**

1. Neuro-fuzzy and soft computing, .S.R. Jang, C.T. Sun, E. Mizutani, Phi (EEE edition), 2012
2. Soft Computing, SarojKaushik, SunitaTiwari, McGrawHill, 2018

| ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Subject Code** | 18AI823 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course will enable students to:

- To understand basic concepts of RPA
- To DescribeRPA,where it can be applied and how it is implemented
- To Describe the different types of variables,Control Flow and data manipulation techniques
- To Underst and Image,Text and DataTables Automation
- To Describe various types of Exceptions and strategies to handle

| **Module – 1** | **Contact Hours** |
|---|---|
| **RPA Foundations**- What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flowcharts.<br>**Textbook 1: Ch 1, Ch 2**<br>**RBT:L1,L2** | 08 |
| **Module – 2** | |
| **RPA Platforms**- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio - Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder.<br>**Textbook 2: Ch 1, Ch 2**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| **Sequence, Flowchart, and Control Flow**-Sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope-Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).<br>**Textbook 2: Ch 3, Ch 4**<br>**RBT:L1,L2** | 08 |
| **Module – 4** | |
| **Taking Control of the Controls**- Finding and attaching windows- Finding the control-Techniques for waiting for a control- Act on controls – mouse and keyboard activities-Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.<br>**Text book 2: Ch 5**<br>**RBT:L1,L2** | 08 |
| **Module – 5** | |

<table>
<tr><td>Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA<br>Text book 2: Ch 8<br>Text book 1: Ch 13<br>RBT:L1,L2</td><td>08</td></tr>
<tr><td colspan="2">Course outcomes: The students should be able to:</td></tr>
<tr><td colspan="2"><ul><li>ToUnderstand the basicconcepts of RPA</li><li>To Describe various components and platforms of RPA</li><li>To Describe the different types of variables,control flow and data manipulation techniques</li><li>To Understand various control techniques and OCR in RPA</li><li>To Describe varioustypes and strategies to handle exceptions</li></ul></td></tr>
<tr><td colspan="2">Question paper pattern:<ul><li>The question paper will have ten questions.</li><li>There will be 2 questions from each module.</li><li>Each question will have questions covering all the topics under a module.</li><li>The students will have to answer 5 full questions, selecting one full question from each module.</li></ul></td></tr>
<tr><td colspan="2">Text Books:</td></tr>
<tr><td colspan="2">1. Tom Taulli , The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : Apress<br>2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher:Packt Publishing Release Date: March 2018 ISBN:9781788470940</td></tr>
<tr><td colspan="2">Reference Books:</td></tr>
<tr><td colspan="2">1. Frank Casale,Rebecca Dilla,Heidi Jaynes,Lauren Livingston,“Introductionto Robotic Process Automation :A Primer”,Institute of Robotic Process Automation.<br>2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks& Become An RPA Consultant<br>3. Srikanth Merianda,Robotic Process Automation Tools,Process Automation and their benefits:Understanding RPA and Intelligent Automation<br>https://www.uipath.com/rpa/robotic-process-automation</td></tr>
</table>

| MODERN INFORMATION RETRIEVAL<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Subject Code** | 18AI824 | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 3 Hrs |
| **CREDITS – 03** | | | |

**Course Learning Objectives:** This course will enable students to:

- To learn the classical techniques of Information Retrieval and extract meaningful patterns from it.
- To get an insight into practical algorithms of textual document indexing, relevant ranking, web mining, text analytics and their performance evaluations.
- To acquire the necessary experience to design, and implement applications using Information Retrieval systems

| Module – 1 | Contact Hours |
|---|---|
| **Introduction:** Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models.<br>**Text Book 1: Chapter 1, Chapter 2** | 08 |
| **Module – 2** | |
| **Retrieval Techniques:** Structured Text Retrieval Models –Retrieval Evaluation – Word Sense Disambiguation.<br>**Text Book 1: Chapter 3** | 08 |
| **Module – 3** | |
| **Querying:** Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis<br>**Text Book 1: Chapter 4, Chapter 5** | 08 |
| **Module – 4** | |
| **Text Operations:** Document Pre-processing – Clustering – Text Compression - Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching.<br>**Text Book 1: Chapter 7, Chapter 8** | 08 |
| **Module – 5** | |
| **User Interface&Applications:** User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points – Query Specification - Context – User relevance Judgment – Interface for Search. Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Metasearchers – Online IR systems – Online Public Access Catalogs.<br>**Text Book 1: Chapter 10, Chapter 13, Chapter 14** | 08 |

**Course outcomes:** The students should be able to:

- Apply information retrieval principles to locate relevant information in large collections of data
- Implement features of retrieval systems for web-based search tasks.
- Apply the common algorithms and techniques for information retrieval related to document indexing and query processing
- Demonstrate a thorough understanding and solid knowledge of the principles and techniques of

human-computer interaction

- Implement graphical user interfaces with modern software tools
- Develop and design interactive software systems applications for real time applications
- Design and develop web applications for the effective informational retrieval

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, Modern Information Retrieval, Pearson Education Asia, 2012.

**Reference Books:**

1. G.G. Chowdhury, Introduction to Modern Information Retrieval, Second Edition, Neal- Schuman Publishers, 2010.

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY
# BELAGAVI

## Scheme of Teaching and Examination and Syllabus
## B.E. CIVIL ENGINEERING
**(Effective from Academic year 2018-19)**

## General Notes:

1. Question Paper Pattern for Theory Courses:
   - The question paper will have TEN questions, Each full question carries 20 marks, There will be two full questions (with a maximum of four subquestions) from each module.Each full question will have sub questions covering all the topicsunder a module.
   - Students will have to answer 5 full questions, selecting one fullquestion from each module.
2. The teaching learning process should be as per the Choice Based CreditSystem
3. All Civil Engineering Departments should have a “CIVIL ENGINEERINGMUSEUM” with collections like models,charts, material samples, fixtures and fittings etc. which assist effectiveteaching learning process.
4. The teaching learning process may be planned to develop capabilities,competencies and skills required for career development based on coursebeginning and course end surveys.
5. Course objectives, course outcomes and RBT levels given under eachcourse in the syllabus are indicative/suggestive. The facultycan set them appropriately according to their lesson/ course plan.
6. The course coordinators/teachers/instructors are informed to deliberatein the faculty meeting with module coordinator, program coordinatoralong with the stake holders to develop the respective lesson/ courseplans.
7. The department advisory board may make suitable changes to thecourse objectives, course outcomes according totheir finalized course plans.
8. The faculty should complement the teaching with case studies and fieldvisits wherever required.
9. At least one faculty development program to be conducted to complimentteaching learning process by the department in a year

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education(OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

**Programme: CIVIL ENGINEERING**

**III SEMESTER**

| Sl. No | Course and Course Code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | BSC | 18MAT31 | Transform Calculus, Fourier Series and Numerical Techniques | Mathematics | 2 | 2 | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18CV32 | Strength of Materials | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18CV33 | Fluid Mechanics | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PCC | 18CV34 | Building Materials and Construction | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | PCC | 18CV35 | Basic Surveying | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18CV36 | Engineering Geology | Geology | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 7 | PCC | 18CVL37 | Computer Aided Building Planning & Drawing | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | PCC | 18CVL38 | Building Materials Testing Laboratory | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | HSMC | 18KVK39 | Vyavaharika Kannada (Kannada for communication)/ | HSMC | -- | 2 | -- | -- | 100 | -- | 100 | 1 |
| | | **OR** | | | | | | | | | | |
| | | 18KAK39 | Aadalitha Kannada (Kannada for Administration) | | | | | | | | | |
| | | **OR** | | | | | | | | | | |
| | | 18CPC39 | Constitution of India, Professional Ethics and Cyber Law | | 1 | -- | -- | 02 | 40 | 60 | | |
| | | | | | Examination is by objective type questions | | | | | | | |
| | | | | **TOTAL** | **17 OR 18** | **08 OR 10** | **04** | **24 OR 26** | **420 OR 360** | **480 OR 540** | **900** | **24** |

**Note:** BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

**Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | NCMC | 18MATDIP31 | Additional Mathematics - I | Mathematics | 02 | 01 | -- | 03 | 40 | 60 | 100 | 0 |

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F

| |
|---|
| grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.<br>(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree. |

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|---|
| **Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs** |
| Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree. |
| |
| **AICTE Activity Points to be earned by students admitted to BE/B. Tech/B. Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):**<br>Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.<br>The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.<br>In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. |
| |

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education(OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

**Programme: CIVIL ENGINEERING**

**IV SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BSC | 18MAT41 | Complex Analysis, Probability And Statistical Methods | Mathematics | 2 | 2 | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18CV42 | Analysis of Determinate Structures | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18CV43 | Applied Hydraulics | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PCC | 18CV44 | Concrete Technology | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | PCC | 18CV45 | Advanced Surveying | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18CV46 | Water Supply & Treatment Engineering | Civil Engg. | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 7 | PCC | 18CVL47 | Engineering Geology Laboratory | Geology | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | PCC | 18CVL48 | Fluid Mechanics and Hydraulic Machines Laboratory | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | HSMC | 18KVK39/49 | Vyavaharika Kannada (Kannada for Communication)/ | HSMC | -- | 2 | -- | -- | 100 | -- | 100 | 1 |
| | | OR | | | | | | | | | | |
| | | 18KAK39/49 | Aadalitha Kannada (Kannada for Administration) | | | | | | | | | |
| | | OR | | | | | | | | | | |
| | | 18CPC39/49 | Constitution of India, Professional Ethics and Cyber Law | | 1 | -- | -- | 02 | 40 | 60 | | |
| | | | | | Examination is by objective type questions | | | | | | | |
| | | | | **TOTAL** | **17** | **08** | **04** | **24** | **420** | **480** | **900** | **24** |
| | | | | | **OR** | **OR** | | **OR** | **OR** | **OR** | | |
| | | | | | **18** | **10** | | **26** | **360** | **540** | | |

**Note:** BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39/49Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39/49Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

**Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs**

| Sl. No | Course | Course code | Course Title | Teaching Department | L | T | P | Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | NCMC | 18MATDIP41 | Additional Mathematics - II | Mathematics | 02 | 01 | -- | 03 | 40 | 60 | 100 | 0 |

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

| |
|---|
| (b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree. |
| **Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs** |
| Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree. |
| |
| **AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. |
| |

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
## Scheme of Teaching and Examination 2018 – 19
## Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
## (Effective from the academic year 2018 – 19)

**Programme: CIVIL ENGINEERING**

**V SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | HSMC | 18CV51 | Construction Management & Entrepreneurship | Civil Engg. | 2 | 2 | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18CV52 | Analysis of Indeterminate Structures | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18CV53 | Design of RC Structural Elements | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 4 | PCC | 18CV54 | Basic Geotechnical Engineering | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | PCC | 18CV55 | Municipal Wastewater Engineering | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18CV56 | Highway Engineering | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 7 | PCC | 18CVL57 | Surveying Practice | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | PCC | 18CVL58 | Concrete and Highway Materials Laboratory | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | HSMC | 18CIV59 | Environmental Studies | Civil/Environmental [Paper setting Board: Civil Engineering] | 1 | -- | -- | 02 | 40 | 60 | 100 | 1 |
| | | | | **TOTAL** | **18** | **10** | **04** | **26** | **360** | **540** | **900** | **25** |

**Note:** PCC: Professional Core, HSMC: Humanity and Social Science.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

**CIVIL ENGINEERING**

Scheme of Teaching and Examination 2018 – 19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018 – 19)

**VI SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18CV61 | Design of Steel Structural Elements | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 2 | PCC | 18CV62 | Applied Geotechnical Engineering | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18CV63 | Hydrology and Irrigation Engineering | Civil Engg. | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 4 | PEC | 18CV64X | Professional Elective -1 | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | OEC | 18CV65X | Open Elective -A | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18CVL66 | Software Application Laboratory | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 7 | PCC | 18CVL67 | Environmental Engineering Laboratory | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | EP | 18CVEP68 | Extensive Survey project | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | Internship | -- | Internship | To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters. | | | | | | | | |
| | | | | **TOTAL** | **15** | **12** | **06** | **24** | **320** | **480** | **800** | **24** |

**Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.**

| **Professional Elective -1** | |
|---|---|
| **Course code under18CV64X** | |
| 18CV641 | Matrix Method of Structural Analysis |

| | |
|---|---|
| 18CV642 | Solid Waste Management |
| 18CV643 | Alternate Building Materials |
| 18CV644 | Ground Improvement Techniques |
| 18CV645 | Railway, Harbours, Tunnelling & Airports |
| **Open Elective -A** | |
| **Course code under18CV65X** | |
| 18CV651 | Remote Sensing & GIS |
| 18CV652 | Traffic Engineering |
| 18CV653 | Occupational Health & Safety |
| 18CV654 | Sustainability Concepts in Civil Engineering |
| **18CV655** | **Intelligent Transportation Systems** |
| **18CV656** | **Conservation of Natural Resources** |

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

**Internship:** All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education(OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

**Programme: CIVIL ENGINEERING**

**VII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18CV71 | Quality Surveying and Contract Management | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18CV72 | Design of RCC and Steel Structures | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 3 | PEC | 18CV73X | Professional Elective - 2 | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PEC | 18CV74X | Professional Elective - 3 | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | OEC | 18CV75X | Open Elective -B | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18CVL76 | Computer Aided Detailing of Structures | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 7 | PCC | 18CVL77 | Geotechnical Engineering Laboratory | Civil Engg. | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | Project | 18CVP78 | Project Work Phase - 1 | | -- | -- | 2 | -- | 100 | -- | 100 | 1 |
| 9 | Internship | -- | Internship | (If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters ) | | | | | | | | |
| | | | | **TOTAL** | **15** | **04** | **06** | **21** | **380** | **420** | **00** | **20** |

**Note:** PCC: Professional core, PEC: Professional Elective.

**Professional Elective - 2**

| **Course code under 18CV73X** | **Course Title** |
|---|---|
| 18CV731 | Theory of Elasticity |
| 18CV732 | Air Pollution and Control |
| 18CV733 | Pavement Materials & Construction |
| 18CV734 | Ground Water Hydraulics |
| 18CV735 | Masonry Structures |

**Professional Electives - 3**

| **Course code under 18CV74X** | **Course Title** |
|---|---|
| 18CV741 | Earthquake Engineering |
| 18CV742 | Design Concepts of Building Services |
| 18CV743 | Reinforced Earth Structures |

| | |
|---|---|
| 18CV744 | Design of Hydraulic Structures |
| 18CV745 | Urban Transport Planning |
| **Open Elective -B** | |
| **Course code under 18CV75X** | **Course Title** |
| 18CV751 | Finite Element Method |
| 18CV752 | Numerical Methods and Applications |
| 18CV753 | Environmental Protection and Management |

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

**Project work:**

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

**CIE procedure for Project Work Phase - 1:**

**(i) Single discipline:**The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**Internship:** All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education(OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

## Programme: CIVIL ENGINEERING

**VIII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18CV81 | Design of Pre-stressed Concrete | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PEC | 18CV82X | Professional Elective - 4 | Civil Engg. | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 3 | Project | 18CVP83 | Project Work Phase - 2 | Civil Engg. | -- | -- | 16 | 03 | 40 | 60 | 100 | 8 |
| 4 | Seminar | 18CVS84 | Technical Seminar | Civil Engg. | -- | -- | 2 | 03 | 100 | -- | 100 | 1 |
| 5 | Internship | 18CVI85 | Internship | Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.) | | | | 03 | 40 | 60 | 100 | 3 |
| | | | | **TOTAL** | **06** | **--** | **18** | **15** | **260** | **240** | **500** | **18** |

**Note:** PCC: Professional Core, PEC: Professional Elective.

**Professional Electives - 4**

| **Course code under 18CV82X** | Course Title |
|---|---|
| 18CV821 | Bridge Engineering |
| 18CV822 | Prefabricated Structures |
| 18CV823 | Advanced Foundation Engineering |
| 18CV824 | Rehabilitation & Retrofitting |
| 18CV825 | Pavement Design |

**Project Work**

**CIE procedure for Project Work Phase - 2:**

**(i) Single discipline:**The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**SEE for Project Work Phase - 2:**

| |
|---|
| **(i) Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.<br>**(ii) Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.<br>**Internship:** Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements. |
| **AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.<br>Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points). |

**B.E.**(Common to all Programmes)

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

**SEMESTER - III**

**TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES**

(Common to all Programmes)

| | | | |
|---|---|---|---|
| Course Code | **18MAT31** | CIE Marks | 40 |
| Teaching Hours/Week (L: T:P) | (2:2:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

**Module-1**

**Laplace Transform:** Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.

**Inverse Laplace Transform**: Definition and problem s, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

**Module-2**

**Fourier Series**: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period $2\pi$ and arbitrary period. Half range Fourier series. Practical harmonic analysis.

**Module-3**

**Fourier Transforms:** Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.

**Difference Equations and Z-Transforms:** Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.

**Module-4**

**Numerical Solutions of Ordinary Differential Equations(ODE's)**:

Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge - Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.

**Module-5**

**Numerical Solution of Second Order ODE's:** Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).

**Calculus of Variations:** Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

**Course outcomes:** At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5:Determine the externals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Advanced Engineering Mathematics | E. Kreyszig | John Wiley & Sons | 10th Edition, 2016 |
| 2 | Higher Engineering Mathematics | B. S. Grewal | Khanna Publishers | 44th Edition, 2017 |
| 3 | Engineering Mathematics | Srimanta Pal et al | Oxford University Press | 3rd Edition, 2016 |
| **Reference Books** | | | | |
| 1 | Advanced Engineering Mathematics | C. Ray Wylie, Louis C. Barrett | McGraw-Hill Book Co | 6th Edition, 1995 |
| 2 | Introductory Methods of Numerical Analysis | S. S. Sastry | Prentice Hall of India | 4th Edition 2010 |
| 3 | Higher Engineering Mathematics | B.V. Ramana | McGraw-Hill | 11th Edition,2010 |
| 4 | A Textbook of Engineering Mathematics | N. P. Bali and Manish Goyal | Laxmi Publications | 6th Edition, 2014 |
| 5 | Advanced Engineering Mathematics | Chandrika Prasad and Reena Garg | Khanna Publishing, | 2018 |

**Web links and Video Lectures:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - III | | | |
|---|---|---|---|
| **STRENGTH OF MATERIALS** | | | |
| Course Code | **18CV32** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To determine slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

**Module-1**

**Simple Stresses and Strain:** Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

**Module-2**

**Compound Stresses:** Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses**.** Theory of failures: Max. Shear stress theory and Max. principal stress theory.

**Thin and Thick Cylinders:** Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

**Module-3**

**Shear Force and Bending Moment in Beams:** Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.

**Module-4**

**Bending and Shear Stresses in Beams:** Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre (only concept).

**Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft.

**Module-5**

**Deflection of Beams:** Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

**Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.

**Course outcomes:** After studying this course, students will be able;

1. To evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To evaluate the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse different internal forces and stresses induced due to representative loads on structural elements.
4. To evaluate slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. B.S. Basavarajaiah, P. Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition,2010
2. Ferdinand P. Beer, E. Russell Johnston and Jr. John T. De Wolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

**Reference Books:**

1. D.H. Young, S.P. Timoshenko "Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint2014).
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010.
3. S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint2013).
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**FLUIDS MECHANICS**

| | | | |
|---|---|---|---|
| Course Code | **18CV33** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to solve practical problem.
3. Principles of Kinematics and Hydrodynamics for practical applications.
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements.

**Module-1**

**Fluids & Their Properties:** Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Newton's law of viscosity (theory & problems), Cohesion, Adhesion, Surface tension, Pressure inside a water droplet, soap bubble and liquid jet. Numerical problems,& Capillarity. Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, Fluid as a continuum,

**Fluid Pressure and Its Measurements:** Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices**.**

**Module-2**

**Hydrostatic forces on Surfaces:** Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

**Fundamentals of fluid flow (Kinematics):** Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three- dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irrational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

**Module-3**

**Fluid Dynamics:** Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses).
Momentum equation problems on pipe bends.

**Applications:** Introduction. Venturi meter, Orifice meter, Pitot tube. Numerical Problems.

**Module-4**

**Orifice and Mouth piece:** Introduction, classification, flow through orifice, hydraulic coefficients and Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).

**Notches and Weirs:** Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.

**Module-5**

**Flow through Pipes:** Introduction. Major and minor losses in pipe flow. Darcy- Weis bach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Numerical problems, .Pipe Networks, Hardy Cross method (No problems on pipe networks),

**Surge Analysis in Pipes:** Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems.

**Course outcomes:** After successful completion of the course, the student will be able to:

1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
2. Compute and solve problems on hydrostatics, including practical applications
3. Apply principles of mathematics to represent kinematic concepts related to fluid flow
4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
5. Compute the discharge through pipes and over notches and weirs

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi


**Reference Books:**


1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed).
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.
4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition.
5. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**BUILDING MATERIALS AND CONSTRUCTION**

| | | | |
|---|---|---|---|
| Course Code | **18CV34** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will develop a student;

1. To recognize good construction materials based on properties.
2. To investigate soil properties and design suitable foundation.
3. To understand the types and properties of masonry materials and supervise masonry construction.
4. To gain knowledge of structural components like lintels, arches, staircase and roofs.
5. To understand the finishes in construction like flooring, plastering, paining.

**Module-1**

**Building Materials**: Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks.

Timber as construction material.

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

**Module-2**

**Foundation:** Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

**Masonry:** Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls.

**Module-3**

**Lintels and Arches**: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.

**Floors and roofs:** Floors; Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.

Roof: Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

**Module-4**

**Doors, Windows and Ventilators**: Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.

**Stairs:** Definitions, technical terms and types of stairs: Wood, RCC, Metal. Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.

**Formwork:** Introduction to form work, scaffolding, shoring, under pinning.

**Module-5**

**Plastering and Pointing:** Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering . Water proofing with various thicknesses.

**Damp proofing-** causes, effects and methods.

**Paints-** Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Select suitable materials for buildings and adopt suitable construction techniques.
2. Decide suitable type of foundation based on soil parameters
3. Supervise the construction of different building elements based on suitability
4. Exhibit the knowledge of building finishes and form work requirements

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

**Textbooks:**


1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,StandardPublishers
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.


**Reference Books:**


1. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd
3. Building Materials and Components, CBRI, 1990,India
4. Jagadish. K.S, "Alternative Building Materials Technology", New Age International,2007.
5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

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| **B. E. CIVIL ENGINEERING**<br>**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**<br>**SEMESTER – III** | | | |
| **BASIC SURVEYING** | | | |
| Course Code | **18CV35** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;

1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

**Module-1**

**Introduction:** Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

**Measurement of Horizontal Distances:** Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.

**Module-2**

**Measurement of Directions and Angles:** Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

**Traversing:** Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems.

**Module-3**

**Leveling:** Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling.

**Module-4**

**Plane Table Surveying:** Plane table and accessories, Advantages and limitations of plane table survey, Orientation and methods of orientation, Methods of plotting – Radiation, Intersection, Traversing, Resection method, Two point and three point problems, Solution to two point problem by graphical method, Solution to three point problem Bessel's graphical method, Errors in plane table survey.

**Module-5**

**Areas and Volumes:** Measurement of area by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- trapezoidal and prismoidal formula.

**Contouring:** Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.

**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Posses a sound knowledge of fundamental principles Geodetics
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems]
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi –2009.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune VidyarthiGrihaPrakashan,1988

**Reference Books:**

1. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009.
2. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. –2010
3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, NewDelhi
4. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., NewDelhi

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**ENGINEERING GEOLOGY**

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|---|---|---|---|
| Course Code | **18CV36** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students;

1. To inculcate the importance of earth's interior and application of Geology in civil engineering. Attempts are made to highlight the industrial applications of minerals.
2. To create awareness among Civil engineers regarding the use of rocks as building materials.
3. To provide knowledge on dynamic Geology and its importance in modifying the physical character of rocks which cause rocks suitable or unsuitable in different civil engineering projects such as Dams, bridges, tunnels and highways.
4. To educate the ground water management regarding diversified geological formations, climatologically dissimilarity which are prevailed in the country. To highlight the concept of rain water harvesting.
5. To understand the application of Remote Sensing and GIS, Natural disaster and management and environmental awareness.

**Module-1**

**Introduction:** Application of Geology in Civil Engineering Practices, Understanding the earth, internal structure and composition.

**Mineralogy:** Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group ( Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chro mite (Alloy); Bauxite (aluminum); Chalcopyrite (copper).

**Module-2**

**Petrology & Geomorphology:** Formation, Classification and Engineering Properties of: **Igneous rocks-**Types of Granite, Dolerite, Basalt, Pumice, Granite Porphyry. **Sedimentary Rocks-** Sandstone, Limestone, Shale, Late rite, Conglomerate. **Metamorphic Rocks-** Gneiss, Slate, Muscovite & Biotite schist, Marble, Quartzite. Rock weathering: types and their effects on Civil Engineering Projects. Landforms, Drainage pattern and types. Soil formation and soil profile. The apprehension of Index properties of rocks: Porosity, Density, Permeability, and Durability. Selection of rocks as materials for construction, as a foundation, Decorative, Flooring, and Roofing, Concrete Aggregate, Road Metal, Railway Ballast with examples.

**Module-3**

**Structural Geology & Rock Mechanics:** Structural aspects of rocks like Outcrop, Dip and strike, Folds, Faults, Joints, Unconformities and their influence on Engineering Projects/structures like dam, tunnels, slope treatment; ground improvement, recognition of the structures in field and their types/classification. Rock Quality Determination (RQD) & Rock Structure Rating (RSR). Geological site characterization: Dam foundations and rock Foundation treatment for dams and Reservoirs heavy structures by grouting and rock reinforcement. Tunnels: Basic terminology and application, site investigations, Coastlines and their engineering considerations.

**Module-4**

**Hydrogeology:** Hydrological cycle, Vertical distribution of groundwater, artesian groundwater in soil and rock. Water Bearing Formations, Aquifer and its types – Aquitard, Aquifuge, and Aquiclude. Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Determination of Quality - SAR, RSC and TH of Groundwater. Groundwater Exploration- Electrical Resistivity and Seismic methods, Artificial Recharge of Groundwater, Rain water harvesting and methods, Seawater intrusion in coastal areas and remedies. Groundwater Pollution. Floods and its control, Cyclone and its effects.

**Module-5**

**Seismology and Geodesy:** Earthquake - Causes and Effects, Seismic waves, engineering problems related to Earthquakes, Earthquake intensity, Richter scale, Seismograph, Seismic zones- World and India. Tsunami causes and effects, Volcanic Eruptions. Landslides (Mass movements) causes, types and remedial measures –stability assessment for soil and rock slopes. Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) –

Concept and their use resource mapping. Aerial Photography, LANDSAT Imagery – Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation

**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Apply geological knowledge in different civil engineering practice.
2. Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials.
3. Civil Engineers are competent enough for the safety, stability, economy and life of the structures that they construct.
4. Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems.
5. Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering construction.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. P.K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd.Kolkatta.
2. Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K.Kataria and Sons, New Dehli.


**Reference Books:**


1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur. Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and Geotechnics", CBS Publishers and Distributors, New Delhi.
2. K V G K Gokhale, "Principles of Engineering Geology", B S Publications, Hyderabad.
3. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
5. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
6. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
7. K. Todd, "Groundwater Hydrology", Tata Mac Grow Hill, NewDelhi.
8. D. Venkata Reddy, "Engineering Geology", New Age International Publications, NewDelhi.
9. S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGrawHill Education (India) Pvt, Ltd. Ne Delhi.
10. M.P Billings, "Structural Geology", CBS Publishers and Distributors, New Delhi.
11. K. S. Valdiya, "Environmental Geology",, Tata Mc Grew Hills.
12. M. B. Ramachandra Rao, "Outlines of Geophysical Prospecting- A Manual for Geologists", Prasaranga, University of Mysore, Mysore

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

| COMPUTER AIDED BUILDING PLANNING AND DRAWING | | | |
|---|---|---|---|
| Course Code | **18CVL37** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Total Number of Lecture/Practice Hours | 02 | Exam Hours | 03 |

**Course Learning Objectives:** Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

**Module:1**

**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

**Simple engineering drawings with CAD drawing tools** : Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

**Module:2**

Drawings Related to Different Building Elements:
Following drawings are to be prepared for the data given using CAD Software

a) Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
b) Different types of bonds in brick masonry.
c) Different types of staircases – Dog legged, Open well.
d) Lintel and chajja.
e) RCC slabs and beams.
f) Cross section of a pavement.
g) Septic Tank and sedimentation Tank.
h) Layout plan of Rainwater recharging and harvesting system.
i) Cross sectional details of a road for a Residential area with provision for all services.¸
j) Steel truss (connections Bolted).

**Note:** Students should sketch to dimension the above in a sketch book before doing the computer drawing.

**Module -3:**

**Building Drawings:** Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for:

1. Single and double story residential building.
2. Hostel building.
3. Hospital building.
4. School building.

Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:

- Students should sketch to dimension the above in a sketch book before doing the computer drawing
- One compulsory field visit/exercise to be carried out.
- Single line diagrams to be given in the examination.

**Course Outcomes:** After studying this course, students will be able to

1. Prepare, read and interpret the drawings in a professional set up.
2. KnowtheproceduresofsubmissionofdrawingsandDevelopworkingandsubmissiondrawingsforbuilding.
3. Plananddesignaresidentialorpublicbuildingasperthegivenrequirements.

**Question paper pattern:**

- There will be four full questions with sub divisions if necessary from Module2 with each full question carrying twenty five marks. Students have to answer any two questions.
- There will be two full questions from Module 3 with each full question carrying fifty marks. Students have to answer any one question. The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. Question papers should be given in batches.

**Textbook:**

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing" , Tata McGraw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.

**Reference Books:**

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**BUILDING MATERIALS TESTING LABORATORY**

| | | | |
|---|---|---|---|
| **Course Code** | **18CVL38** | **CIE Marks** | **40** |
| **Teaching Hours/Week(L:T:P)** | **(0:2:2)** | **SEE Marks** | **60** |
| **Credits** | **02** | **Exam Hours** | **03** |

**Course Learning Objectives: The objectives of this course is to make students to learn:**

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

**Experiments:**

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections.
4. Bending Test on Wood Under two point loading.
5. Shear Test on Mild steel- single and double shear.
6. Impact test on Mild Steel (Charpy & Izod).
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's.
8. Tests on Bricks, Tiles and Concrete Blocks.
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking.
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.
11. Demonstration of Strain gauges and Strain indicators.

**NOTE: All tests to be carried out as per relevant latest BIS Codes**

**Course Outcomes:** After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

**Question paper pattern:**

- Group experiments - Tension test, compression test, torsion test and bending test.
- Individual Experiments – Remaining tests.
- Two questions are to be set - One from group experiments and the other as individual experiment.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Reference Books:**

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education (India)Pvt. Ltd.,2014.
3. Fenner, "Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd. New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors1996.
7. Relevant **latest IS Codes.**

**B. E. (Common to all Programmes)**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER –II / III / IV**

## Aadalitha Kannada

| | | | |
|---|---|---|---|
| Course Code | **18KAK28/39/49** | CIE Marks | 100 |
| Teaching Hours/Week (L:T:P) | (0:2:0) | | |
| Credits | 01 | | |

**ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:**

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ. ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

**ಪರಿವಿಡಿ (ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)**

ಅಧ್ಯಾಯ – 1 ಕನ್ನಡಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.

ಅಧ್ಯಾಯ – 2 ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ.

ಅಧ್ಯಾಯ – 3 ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ – 4 ಪತ್ರ ವ್ಯವಹಾರ.

ಅಧ್ಯಾಯ – 5 ಆಡಳಿತ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 6 ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 7 ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ.

ಅಧ್ಯಾಯ – 8 ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ.

ಅಧ್ಯಾಯ – 9 ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ.

ಅಧ್ಯಾಯ – 10 ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

**ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳು:**

- ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡದ ಪರಿಚಯವಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳು ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.

**ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ –** ಅಖಇ **(ಅಠಿಣಟಿಣಿಷ ಖಟಿಣಜಿಟಿಚಿಟ ಇತಿಚಿಟಣಚಿಣಿ):**
ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

**ಪಠ್ಯಪುಸ್ತಕ : ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಏಚಿಟಿಟಿಚಿಜಚಿ ಜಿಡಿ ಂಜಟಮಿಡಿಚಿಣಟ)**

**ಸಂಪಾದಕರು**

**ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ**

**ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ**

**ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.**

| **B. E. (Common to all Programmes)**<br>**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**<br>**SEMESTER –II & III/IV** | | | |
|---|---|---|---|
| **Vyavaharika Kannada** | | | |
| Course Code | **18KVK28/39/49** | CIE Marks | 100 |
| Teaching Hours/Week (L:T:P) | (0:2:0) | | |
| Credits | 01 | | |

**Course Learning Objectives:**

The course will enable the students to understand Kannada and communicate in Kannada language.

**Table of Contents:**

Chapter - 1: Vyavaharika kannada – Parichaya (Introduction to Vyavaharika Kannada).
Chapter - 2: Kannada Aksharamale haagu uchcharane ( Kannada Alpabets and Pronunciation).
Chapter - 3: Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication).
Chapter - 4: Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana).
Chapter - 5: Activities in Kannada.

**Course Outcomes:**

At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.

**ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – ಅಖಇ (ಅಡಿಣುಟಿಣಾ ಖಟಣಜಾಟಿಚಿಟ ಇತುಚಿಟಣಚಿಣುಟಿ):**

ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

**ಖಿಜ್ಞಾಃಜ್ಞಾ (ಪಠ್ಯಪುಸ್ತಕ): ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಗಿಥಿಚಿತುಛಿಚಿಡಿಜಾಚಿ ಏಚಿಟಿಟಿಚಿಜಚಿ ಖಿಜ್ಞಾ ಃಜ್ಞಾ)**

ಸ಼ಂಪಾದಕರು

**ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ**

**ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ**

**ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.**

**B. E. AUTOMOBILE ENGINEERING**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER - III**

**CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)**

| | | | |
|---|---|---|---|
| Course Code | **18CPC39/49** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (1:0:0) | SEE Marks | 60 |
| Credits | 01 | Exam Hours | 02 |

**Course Learning Objectives:** To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

**Module-1**

**Introduction to Indian Constitution:** The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

**Module-2**

**Union Executive and State Executive:** Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States.

**Module-3**

**Elections, Amendments and Emergency Provisions:** Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.

**Constitutional special provisions:** Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

**Module-4**

**Professional / Engineering Ethics:** Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

**Module-5**

**Internet Laws, Cyber Crimes and Cyber Laws:** Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

**Course Outcomes:** On completion of this course, students will be able to,

- CO1: Have constitutional knowledge and legal literacy.
- CO2: Understand Engineering and Professional ethics and responsibilities of Engineers.
- CO3: Understand the the cybercrimes and cyber laws for cyber safety measures.

**Question paper pattern for SEE and CIE:**

- The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
- For the award of 40 CIE marks, refer the University regulations 2018.

| **Sl. No.** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Constitution of India, Professional Ethics and Human Rights | Shubham Singles, Charles E. Haries, and et al | Cengage Learning India | 2018 |
| 2 | Cyber Security and Cyber Laws | Alfred Basta and et al | Cengage Learning India | 2018 |
| **Reference Books** | | | | |
| 3 | Introduction to the Constitution of India | Durga Das Basu | Prentice –Hall, | 2008. |
| 4 | Engineering Ethics | M. Govindarajan, S. Natarajan, V. S. Senthilkumar | Prentice –Hall, | 2004 |

**B. E.** Common to all Programmes
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - III**

**ADDITIONAL MATHEMATICS – I**
(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)

| | | | |
|---|---|---|---|
| Course Code | **18MATDIP31** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (2:2:0) | SEE Marks | 60 |
| Credits | 0 | Exam Hours | 03 |

**Course objectives:**

- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODE's.

**Module-1**

**Complex Trigonometry:** Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
**Vector Algebra:** Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

**Module-2**

**Differential Calculus**: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.

**Module-3**

**Vector Differentiation**: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.

**Module-4**

**Integral Calculus**: Review of elementary integral calculus. Reduction formulae for $\sin^n x$, $\cos^n x$ (with proof) and $\sin^m x \cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.

**Module-5**

**Ordinary differential equations (ODE's**. Introduction-solutions of first order and first degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.

**Course outcomes:** At the end of the course the student will be able to:

- CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
- CO4: Learn techniques of integration including the evaluation of double and triple integrals.

CO5: Identify and solve first order ordinary differential equations.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook** | | | | |
| 1 | Higher Engineering Mathematics | B.S. Grewal | Khanna Publishers | 43rd Edition, |

| | | | | |
|---|---|---|---|---|
| | | | | 2015 |
| **Reference Books** | | | | |
| 1 | Advanced Engineering Mathematics | E. Kreyszig | John Wiley & Sons | $10^{th}$ Edition, 2015 |
| 2 | Engineering Mathematics | N.P.Bali and Manish Goyal | Laxmi Publishers | 7th Edition, 2007 |
| 3 | Engineering Mathematics Vol.I | Rohit Khurana | Cengage Learning | $1^{st}$ Edition, 2015 |

**B.E.**(Common to all Programmes)
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER - IV**

**COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS**
(Common to all Programmes)
[As per Choice Based Credit System (CBCS) scheme]

| | | | |
|---|---|---|---|
| Course Code | **18MAT41** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (2:2:0) | SEE Marks | 60 |
| Credits | 3 | Exam Hours | 03 |

**Course Learning Objectives:**

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

**Module-1**

**Calculus of complex functions:** Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions: Milne-Thomson method-Problems.

**Module-2**

**Conformal transformations:** Introduction. Discussion of transformations: $w=z^2$, $w=e^z$, $w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems.
**Complex integration**: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

**Module-3**

**Probability Distributions:** Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

**Module-4**

**Curve Fitting:** Curve fitting by the method of least squares- fitting the curves of the form-
$y = ax + b, y = ax^b$ & $y = ax^2 + bx + c.$
**Statistical Methods:** Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.

**Module-5**

**Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation and covariance.
**Sampling Theory:** Introduction to sampling distributions, standard error,Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

**Course outcomes:** At the end of the course the student will be able to:

- CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- CO2: Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- CO3: Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- CO4: Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- CO5: Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Advanced Engineering Mathematics | E. Kreyszig | John Wiley & Sons | $10^{th}$ Edition,2016 |
| 2 | Higher Engineering Mathematics | B. S. Grewal | Khanna Publishers | $44^{th}$ Edition, 2017 |
| 3 | Engineering Mathematics | Srimanta Pal et al | Oxford University Press | $3^{rd}$ Edition,2016 |
| **Reference Books** | | | | |
| 1 | Advanced Engineering Mathematics | C. Ray Wylie, Louis C. Barrett | McGraw-Hill | $6^{th}$ Edition 1995 |
| 2 | Introductory Methods of Numerical Analysis | S. S. Sastry | Prentice Hall of India | $4^{th}$ Edition 2010 |
| 3 | Higher Engineering Mathematics | B.V. Ramana | McGraw-Hill | $11^{th}$ Edition,2010 |
| 4 | A Textbook of Engineering Mathematics | N. P. Bali and Manish Goyal | Laxmi Publications | $6^{th}$ Edition, 2014 |
| 5 | Advanced Engineering Mathematics | Chandrika Prasad and Reena Garg | Khanna Publishing, | 2018 |

**Web links and Video Lectures:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

**B. E. CIVIL ENGINEERING**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER – IV**
**ANALYSIS OF DETERMINATE STRUCTURES**

| | | | |
|---|---|---|---|
| Course Code | **18CV42** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. To understand different forms of structural systems.
2. To understand concept of ILD and moving loads.
3. To determine slopes and deflections of beams and trusses.
4. To analyse arches and cables.

**Module-1**

**Introduction and Analysis of Plane Trusses:** Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems.

**Influence Lines:** Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses and numerical problems.

**Module-2**

**Moving Loads:** Reactions, BM and SF in determinate beams, axial forces in determinate trusses for rolling loads using ILD (Max. values and absolute max. values for beams subjected to multiple loads).

**Module-3**

**Deflection of Beams:** Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections

**Module-4**

**Energy Principles and Energy Theorems:** Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castig liano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.

**Module-5**

**Arches and Cable Structures:** Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

**Course Outcomes:** After studying this course, students will be able to:

1. Identify different forms of structural systems.
2. Construct ILD and analyse the beams and trusses subjected to moving loads
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and beams.
4. Determine the stress resultants in arches and cables.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., NewDelhi,2015.
3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi,2002.

**Reference Books:**

1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition,2014.

2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi,2008.
3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd,2007.

## CIVIL ENGINEERING
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

### APPLIED HYDRAULICS

| | | | |
|---|---|---|---|
| Course Code | **18CV43** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

**Module-1**

**Dimensional analysis:** Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications. **Model analysis:** Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynolds's, and Froude's Model

**Buoyancy and Flotation:** Buoyancy, Force and Centre of Buoyancy, Meta centre and Meta centric height, Stability of submerged and floating bodies, Determination of Meta centric height, Experimental and theoretical method, Numerical problems.

**Module-2**

**Open Channel Flow Hydraulics:** Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Numerical Problems

**Module-3**

**Non-Uniform Flow:** Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems on identifying the flow profiles

**Module-4**

**Impact of jet on Curved vanes:** Introduction, Impulse-Momentum equation. Direct impact of a jet on stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems.

**Turbines – Impulse Turbines:** Introduction to turbines, General lay out of a hydro- electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel- components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems.

**Module-5**

**Reaction Turbines and Pumps:** Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, NewDelhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi.


**Reference Books:**


1. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co.Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford UniversityPress.
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Publication –2010.
4. J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company.-2009.

| CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - IV | | | |
|---|---|---|---|
| **CONCRETE TECHNOLOGY** | | | |
| Course Code | **18CV44** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

**Module-1**

**Concrete Ingredients** Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.

**Module-2**

**Fresh Concrete** Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

**Module-3**

**Hardened Concrete** Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

**Module-4**

**Concrete Mix Proportioning**

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.

**Module-5**

**Special Concretes**

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete.

**Course outcomes:** After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behavior based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
4. Adopt suitable concreting methods to place the concrete based on requirement.
5. Select a suitable type of concrete based on specific application.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (NewEdition).

**Reference Books:**

1. M L Gambir, "Concrete Technology", McGraw Hill Education,2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning,2015.
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

## ADVANCED SURVEYING

| | | | |
|---|---|---|---|
| Course Code | **18CV45** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Objectives:** This course will enable students to

1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

**Module-1**

**Theodolite Survey and Instrument Adjustment:** Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite.

**Trigonometric Levelling**: Trigonometric leveling (heights and distances-single plane and double plane methods).

**Module-2**

**Tacheometry:** Basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems.

**Geodetic Surveying**: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations.

**Module-3**

**Curve Surveying:**

Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (Numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two Parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics, numerical problems on Length of Transition curve, Vertical curves & Types – (theory).

**Module-4**

**Aerial Photogrammetry**

Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problen Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of ae survey, overlaps and mosaics, Stereoscopes, Derivation Parallax.

**Module-5**

**Modern Surveying Instruments**

Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey.

**Remote Sensing:** Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system

**Geographical Information System:** Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).

**Course outcomes:** After a successful completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems
2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
4. Design and implement the different types of curves for deviating type of alignments.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. B.C. Punmia, “Surveying Vol.2”, Laxmi Publications pvt. Ltd., New Delhi.
2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part 2, Pune Vidyarthi Griha Prakashan,
3. K.R. Arora, “Surveying Vol. 1” Standard Book House, New Delhi.
4. SateeshGopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

**Reference Books:**

1. S.K. Duggal, “Surveying Vol. I & II”, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBSpublishers
4. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
5. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and SonsIndia
6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw HillPublication.
7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill HigherEducation.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

## WATER SUPPLY AND TREATMENT ENGINEERING

| | | | |
|---|---|---|---|
| Course Code | **18CV46** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

**Module -1**

**Introduction**: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor.
**Design period** and factors governing design period. Methods of population forecasting and numerical problems

**Module -2**

**Water Treatment**: Objectives, Unit flow diagrams – significance of each unit: Sources and Characteristics of surface and subsurface sources and Suitability. Sampling : Objectives, methods and preservation techniques. Drinking water quality standards as per BIS. Effect of water quality parameters.
**Intake structures** – types. Factors to be considered in selection of site for intake structures. Aeration process, limitations, types and two film theory.

**Module -3**

**Sedimentation** -theory, settling tanks, types and design. Coagulation and flocculation, Clarriflocculators (circular and rectangular). theory, types of coagulants, coagulant feeding devices. Jar test apparatus and estimation of coagulants.
**Filtration**: mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system

**Module -4**

**Disinfection**: Theory of disinfection. Methods of disinfection with merits and demerits. Chlorination: Break point chlorination and determination of chlorine demand. Estimation of quantity bleaching powder.
**Miscellaneous treatment Process:** Softening: Lime soda and Zeolite process. Estimation of Hardness. Fluoridation and De-fluoridation, Nalagonda Technique. RO and Nano filtration process with merits and demerits.

**Module -5**

**Collection and Conveyance of water**: Types of pumps with working principles and numerical Problems. Design of the economical diameter for the rising main.
Pipe appurtenances, Valves, Fire hydrants and different Pipe materials with their advantages and disadvantages. Factors affecting selection of pipe material.
**Distribution system**: Methods: Gravity, Pumping and Combined gravity and pumping system. Types of Distribution system. Service reservoirs and their capacity determination plant units and distribution system with population forecasting for the given city.

**Course Outcomes:** After studying this course, students will be able to:
1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York,2000
2. S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
3. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.


**Reference Books:**


1. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York,2008.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

## ENGINEERING GEOLOGY LABORATORY

| | | | |
|---|---|---|---|
| Course Code | **18CVL47** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives**: This course will enable students

1. To expose the students to identify the minerals and rocks based on their inherent properties and uses in civil engineering,
2. To educate the students in the interpretation of the geological maps related to civil engineering projects.
3. Students will learn the dip and strike, thickness of strata, Bore hole problems related to geological formation related to foundation, tunnels, reservoirs and mining.
4. Students will understand the Field knowledge by visiting the site like problems Faults, Folds, Joints, Unconformity etc.

**Experiments**

1. Physical properties of minerals: Identification of
   - i. **Rock Forming minerals -** Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Asbestos, Calcite, Gypsum, etc
   - ii. **Ore forming minerals-** Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc
2. Engineering Properties of Rocks: Identification of
   - i. **Igneous rocks-** Types of Granites, Dolerite, Granite Porphyry, Basalt, Pumice etc
   - ii. **Sedimentary rocks-** Sandstone, Lime stone, Shale, Laterite, Breccia etc
   - iii. **Metamorphic rocks-** Gneiss, Slate, Schist, Marble, Quartzite etc
3. Borehole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square methods. (2 methods)
4. Dip and Strike problems. Determine Apparent dip and True dip. (2 methods)
5. Calculation of Vertical, True thickness and width of the outcrops. (3 methods)
6. Study of Toposheets and Interpretation, Extraction of Drainage Basin and its Morphometric Analysis. (3Toposheets)
7. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc. (10 Maps)
8. Interpretation of Satellite Images. (2 Satellite images)
9. Field work– To identify Minerals, Rocks, Geomorphology and Structural features with related to the Civil Engineering projects.

**Course outcomes**: During this course, students will develop expertise in;

1. The students able to identify the minerals, rocks and utilize them effectively in civil engineering practices.
2. The students will interpret and understand the geological conditions of the area for implementation of civil engineering projects.
3. The students will interpret subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
4. The students will learn the techniques in the interpretation of LANDSAT Imageries to find out the lineaments and other structural features for the given area.
5. The students will be able to identify the different structures in the field.

**Reference Books:**


1. MP Billings, Structural Geology, CBS Publishers and Distributors, New Delhi.
2. B.S. Satyanarayana Swamy, Engineering Geology Laboratory Manual, Dhanpat Rai Sons, New Delhi.
3. LRA Narayan, remote sensing and its applications, UniversityPress.
4. P.K.MUKERJEE, Textbook of Geology, WorldPress Pvt. Ltd., Kolkatta
5. JohnI Plattand John Challinor, Simple Geological Structures,ThomasMurthy&Co, London.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - IV**

**FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY**

| | | | |
|---|---|---|---|
| Course Code | **18CVL48** | CIE Marks | 40 |
| Teaching ours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;
1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

**Experiments:**
1. Verification of Bernoulli's equation.
2. Determination of Cd for Venturimeter and Orifice meter.
3. Determination of hydraulic coefficients of small vertical orifice.
4. Determination of $C_d$ for Rectangular and Triangular notch
5. Determination of $C_d$ for Ogee and Broad crested weir
6. Determination of $C_d$ for Venturiflume
7. Determination of force exerted by a jet on flat and curved vanes.
8. Determination of efficiency of Pelton wheel turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major Loss in Pipes
13. Determination of Minor losses in pipe due to sudden enlargement, sudden contraction and bend.

**Course outcomes:** During the course of study students will develop understanding of:
1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him.
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

**Reference Books:**

1. Sarbjit Singh , Experiments in Fluid Mechanics - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi& D r S.M. Seth, Standard Book House- New Delhi. 2009Edition

**B. E. CIVIL ENGINEERING**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER - IV**

**ADDITIONAL MATHEMATICS – II**
(Mandatory Learning Course: Common to All Branches)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)

| | | | |
|---|---|---|---|
| Course Code | **18MATDIP41** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (2:1:0) | SEE Marks | 60 |
| Credits | 00 | Exam Hours | 03 |

**Course Learning Objectives:**
- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

**Module-1**

**Linear Algebra:** Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

**Module-2**

**Numerical Methods:** Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one

**Module-3**

**Higher order ODE's:** Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular Integral restricted to $R(x) = e^{ax}, \frac{sinax}{cosax}, x^n \; for \; f(D)y = R(x)$.

**Module-4**

**Partial Differential Equations (PDE's):** Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

**Module-5**

**Probability:** Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

**Course Outcomes:** At the end of the course the student will be able to:
- Solve systems of linear equations using matrix algebra.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Classify partial differential equations and solve them by exact methods.
- Apply elementary probability theory and solve related problems.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

| Sl. No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook** | | | | |
| 1 | Higher Engineering Mathematics | B.S. Grewal | Khanna Publishers | 43rd Edition, 2015 |
| **Reference Books** | | | | |

| | | | | |
|---|---|---|---|---|
| 1 | Advanced Engineering Mathematics | E. Kreyszig | John Wiley & Sons | $10^{th}$ Edition, 2015 |
| 2 | Engineering Mathematics Vol. I | Rohit Khurana | Cengage Learning | 2015. |
| | | | | |

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

## CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP

| | | | |
|---|---|---|---|
| Course Code | **18CV51** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (2:2:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties.

**Module -1**

**Management:** Characteristics of management, functions of management, importance and purpose of planning process, types of plans.
**Construction Project Formulation:** Introduction to construction management, project organization, management functions, management styles.
**Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method, concept of activity on arrow and activity on node.

**Module -2**

**Resource Management:** Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.
**Construction Equipments:** classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance
**Materials:** material management functions, inventory management.

**Module -3**

**Construction Quality , safety and Human Values:**
Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management
**HSE: Introduction** to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.
**Ethics :** Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

**Module -4**

**Introduction to engineering economy:** Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.
**Interest and time value of money:** concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.
**Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.

**Module -5**

**Entrepreneurship:** Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC.

**Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

**Course Outcomes:** After studying this course, students will be able to:

1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.
2. Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.
3. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
4. Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education
2. Chitkara, K.K, “Construction Project Management: Planning Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of PearsonEducation
4. Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:

**Reference Books:**

1. Robert L Peurifoy, Clifford J. Schexnayder, AviadShapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-HillEducation
2. Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, NewDelhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, “Ethics in Engineering”, McGraw-HillEducation
5. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall,Pitsburgh
6. James L.Riggs, David D. Bedworth , Sabah U. Randhawa “ Engineerng Economics” 4

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**ANALYSIS OF INDETERMINATE STRUCTURES**

| | | | |
|---|---|---|---|
| Course Code | **18CV52** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. communicate effectively in design of structural elements

**Module-1**

**Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3.

**Module-2**

**Moment Distribution Method:** Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3.

**Module-3**

**Kani's Method:** Introduction, Concept, Relationships between bending momentand deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway.

**Module-4**

**Matrix Method of Analysis ( Flexibility Method) :** Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3.

**Module-5**

**Matrix Method of Analysis (Stiffness Method):** Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3.

**Course Outcomes:** After studying this course, students will be able to:

1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and frames using flexibility method
5. Analyze the beams and indeterminate frames by system stiffness method.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Hibbeler R C, **" Structural Analysis",** Pearson Publication
2. L S Negi and R S Jangid, **"Structural Analysis",** Tata *McGraw-Hill* Publishing Company Ltd.
3. D S PrakashRao, **"Structural Analysis: A Unified Approach"** , Universities Press
4. K.U. Muthu, H. Narendraetal, **"Indeterminate Structural Analysis",** IK International Publishing Pvt. Ltd.


**Reference Books:**

1. Reddy C S, **“Basic Structural Analysis”,**Tata McGraw-Hill Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **“Theory of Structures”**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M MRatwani, **“Analysis Of Structures** ”, Vol. 2, Khanna Publishers
4. Wang C K, **“Intermediate Structural Analysis”,** McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **“Computational Structural Mechanics”,** PHI Learning Pvt. Ltd.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

## DESIGN OF RC STRUCTURAL ELEMENTS

| | | | |
|---|---|---|---|
| Course Code | **18CV53** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Provide knowledge in analysis and design of RC elements.

**Module-1**

**Introduction to working stress and limit State Design:** Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

**Module-2**

**Limit State Analysis of Beams:**

Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

**Module-3**

**Limit State Design of Beams:** Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.

**Module-4**

**Limit State Design of Slabs and Stairs:** Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

**Module-5**

**Limit State Deign of Columns and Footings:** Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.

**Textbooks:**

1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

**Reference Books:**

1. P C Varghese, “Limit State design of reinforced concrete” , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publishers.
3. Kong and Evans, “Reinforced and Pre-Stressed Concrete”, Springer Publications.
4. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press.
5. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**BASIC GEOTECHNICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV54** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assesstheimprovementinmechanicalbehaviourbydensificationofsoildeposits using compaction.
5. Model and measure strength-deformation characteristics of soils.

**Module-1**

**Introduction:** Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.
Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis(sieve and Hydrometer analysis)
Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

**Module-2**

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering
**Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

**Module -3**

**Flow through Soils:** Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.
**Seepage Analysis:** Laplace equation, assumptions, limitation sand its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section.
Unconfined flow, phreaticline (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.
**Effective Stress Analysis:**
Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

**Module -4**

**Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

**Module-5**

**Consolidation of Soil:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidationtheory-assumptionsandlimitations.GoverningdifferentialEquation and solution (No derivation).
Consolidation characteristics of soil ($C_C$, $a_V$, $m_V$ and $C_V$). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.

Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

**Course outcomes:** On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India.


**Reference Books:**


1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS)and Outcome Based Education (OBE)**
**SEMESTER - V**

**MUNICIPAL WASTEWATER ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV55** | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;
1. Understand the various water demands and population forecasting methods.
2. Understand and design different unit operations and unit process in involved in wastewater treatment process
3.Understand the concept and design of various physicochemical treatment units
4. Understand the concept and design of various biological treatment units
5. Understand the concept of various advance waste water and low cost treatment processes for rural areas.

**Module-1**

**Introduction**: Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow, numericals.
**Sewer appurtenances**: Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.

**Module-2**

**Design of sewers**: Hydraulic formula to determine velocity and discharge. Self cleansing and non scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.
**Waste water characteristics**: sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water
Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, $1^{st}$ order and $2^{nd}$ order).

**Module-3**

**Treatment of municipal waste water**: Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks.
**Disposal of effluents:** Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.

**Module-4**

**Biological Treatment Process:** Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors.
Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds.

**Module-5**

**Advanced Wastewater Treatment**: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation processes (AOPs), Electro coagulation.
**Rural sanitation:** Low cost treatment process: Working principal and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits.

**Course outcomes:** After studying this course, the students will be able to:
1. Select the appropriate sewer appurtenances and materials in sewer network.
2. Design the sewers network and understand the self purification process in flowing water.
3.Deisgn the varies physic- chemical treatment units
4. Design the various biological treatment units
5. Design various AOPs and low cost treatment units.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks**

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2nd, 2016
3. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
4. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

**Reference Books**

1. CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi,1999
2. Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
3. Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey 2012
4. Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**HIGHWAY ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV56** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

**Module -1**

**Principles of Transportation Engineering:** Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.

**Highway Development and Planning:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.

**Highway Alignment and Surveys**: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.

**Module -2**

**Highway Geometric Design of horizontal alignment elements:** Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Radius of curve, Transition curve, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.

**Module -3**

**Pavement Materials:** Sub grade soil - desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.

**Module -4**

**Pavement Construction:** Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base iii) WMM base,iv) Bituminous Macadam v) Dense Bituminous Macadam vi) Bituminous Concrete,vii) Dry Lean Concrete sub base and PQC viii) concrete roads.

**Module -5**

**Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

**Highway Economics:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

**Course Outcomes:** After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. S K Khanna and C E G Justo, “Highway Engineering”, Nem Chand Bros, Roorkee.
2. L R Kadiyali, “Highway Engineering”, Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, “Highway Engineering”, University Press.
4. K. P.Subramanium, “Transportation Engineering”, SciTech Publications, Chennai.


**Reference Books:**


1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, “Transportation Engineering”, PHI Learning Pvt. Ltd. New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - V**

**SURVEYING PRACTICE**

| | | | |
|---|---|---|---|
| Course Code | **18CVL57** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Apply the basic principles of engineering surveying and measurements
2. Followeffectivelyfieldproceduresrequiredforaprofessionalsurveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
   b) Setting out perpendiculars. Use of cross staff, optical square.
2. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
3. Determination of distance between two inaccessible points using compass and
4. Determination of reduced levels of points using dumpy level/auto level (simple
5. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling).
6. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error.
7. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale.
8. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.
9. Determination of horizontal distance and vertical height to a base in accessible object using theodolite by single plane and double plane method.
10. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
11. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule and Bowditch rule.
12. To locate the points using Radiation and Intersection method of Plane table surveying.
13. To solve three point problem in plane table using Bessel's graphical solution.
14. DemonstrationofMinorinstrumentslikeClinometer,CeylonGhattracer,Boxsextant,Hand level, Planimeter, nautical extant and Penta graph.

**Course Outcomes:** After a successful completion of the course, the student will be able to:
1. Apply the basic principles of engineering surveying and for linear and angular measurements.
2. Comprehendeffectivelyfieldproceduresrequiredforaprofessionalsurveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

**Question paper pattern:**
- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Textbooks:**


1. B.C.Punmia,"SurveyingVol.1",LaxmiPublicationspvt.Ltd.,NewDelhi– 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988.

| **Reference Books:** |
|---|
| 1. S. K. Duggal, “SurveyingVol.1”,Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2009.<br>2. K.R.Arora, “SurveyingVol.1” Standard Book House, New Delhi.–2010. |

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - V | | | |
|---|---|---|---|
| **CONCRETE AND HIGHWAY MATERIALS LABORATORY** | | | |
| Course Code | **18CVL58** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students

1. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. To learn the procedure of testing bituminous materials as per standard code recommendations.
3. To relate material characteristics to various application of construction.

**Modules**

**Part A: Concrete Lab**

1. Tests on Cement:
   a. Normal Consistency
   b. Setting time
   c. Compressive strength
   d. fineness by air permeability test
   e. specific gravity
2. Tests on Concrete:
   a. Design of concrete mix as perIS-10262
   b. Tests on fresh concrete:
      i. slump,
      ii. compaction factor and
      iii. Vee Bee test
   c. Tests on hardened concrete:
      i. compressive strength test,
      ii. split tensile strength test,
      iii. flexural strength test
   d. NDT tests by re bound hammer and pulse velocity test.
3. Tests on Self Compacting Concrete:
   a. Design of self compacting concrete, As per Is 10262:2019
   b. slump flow test,
   c. V-funnel test,
   d. J-Ring test,
   e. U Box test and
   f. L Box test

**Part B: Highway materials Lab**

1. Tests on Aggregates
   a. Aggregate Crushing value
   b. Los Angeles abrasion test
   c. Aggregate impact test
   d. Aggregate shape tests(combined index and angularity number)
2. Tests on Bituminous Materials
   a. Penetration test
   b. Ductility test
   c. Softening point test
   d. Specific gravity test
   e. Viscosity test by tarviscometer
   f. Bituminous Mix Design by Marshal Method (Demonstration only)
3. Tests on Soil
   a. Wet sieve analysis
   b. CBR test

**Course Outcomes:** During this course, students will develop expertise in

1. Able to interpret the experimental results of concrete and highway materials based on laboratory tests.
2. Determine the quality and suitability of cement.
3. Design appropriate concrete mix Using Professional codes.
4. Determine strength and quality of concrete.
5. Evaluate the strength of structural elements using NDT techniques.
6. Test the soil for its suitability as sub grade soil for pavements.

**Question paper pattern:**

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Reference Books:**


1. M. L. Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand &Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual", Nem Chand Bros, Roorkee.
7. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.

**B.E IN CIVIL ENGINEERING(CV-2018-19)**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER – V**

## ENVIRONMENTAL STUDIES

| | | | |
|---|---|---|---|
| Course Code | **18CIV59** | CIE Marks | 40 |
| Teaching Hours / Week (L:T:P) | (1:0:0) | SEE Marks | 60 |
| Credits | 01 | Exam Hours | 02 |

**Module - 1**

**Ecosystems** (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
**Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

**Module - 2**

**Advances in Energy Systems** (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
**Natural Resource Management** (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

**Module - 3**

**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

**Module - 4**

**Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

**Module - 5**

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
**Field work:** Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

**Course outcomes:** At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

**Question paper pattern:**

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook/s** | | | | |
| 1 | Environmental Studies | Benny Joseph | Tata Mc Graw – Hill. | 2nd Edition, 2012 |

| | | | | |
|---|---|---|---|---|
| 2. | Environmental Studies | S M Prakash | Pristine Publishing House, Mangalore | 3rd Edition, 2018 |
| 3 | Environmental Studies – From Crisis to Cure | R Rajagopalan | Oxford Publisher | 2005 |
| **Reference Books** | | | | |
| 1 | Principals of Environmental Science and Engineering | Raman Sivakumar | Cengage learning, Singapur. | 2nd Edition, 2005 |
| 2 | Environmental Science – working with the Earth | G.Tyler Miller Jr. | Thomson Brooks /Cole, | 11th Edition, 2006 |
| 3 | Text Book of Environmental and Ecology | Pratiba Sing, AnoopSingh& PiyushMalaviya | Acme Learning Pvt. Ltd. New Delhi. | 1st Edition |

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VI | | | |
|---|---|---|---|
| **DESIGN OF STEEL STRUCTURAL ELEMENTS** | | | |
| Course Code | **18CV61** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

**Module -1**

**Introduction:** Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

**Plastic Behavior of Structural Steel:** Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

**Module -2**

**Bolted Connections:** Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.

**Welded Connections:** Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

**Module -3**

**Design of Compression Members:** Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

**Module -4**

**Design of Tension Members:** Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

**Design of Column Bases:** Design of Simple Slab Base and Gusseted Base.

**Module -5**

**Design of Beams:** Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems].

**Course Outcomes:** After studying this course, students will be able to:

1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. N Subramanian., “Design of Steel Structures” (2016), Oxford University Press, New Delhi.
2. Duggal S K., “Limit State Method of Design of Steel Structures”, Tata McGraw Hill, New Delhi.

**Reference Books:**

1. Dayarathnam P, “Design of Steel Structures”, Scientific International Pvt. Ltd.
2. Kazim S M A and Jindal R S, “Design of Steel Structures”, Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**APPLIED GEOTECHNICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV62** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geo-technology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

**Module-1**

**Soil Exploration:** Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

**Module-2**

**Stress in Soils**: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.
**Foundation Settlement**: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

**Module-3**

**Lateral Earth Pressure**: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.
**Stability of Slopes :**Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts.

**Module-4**

**Bearing Capacity of Shallow Foundation:** Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.

**Module-5**

**Pile Foundations:** Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

**Course outcomes:** On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

**Question paper pattern:**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.
3. P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
4. Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16thEdition, Laxmi Publications co., New Delhi.


**Reference Books:**


1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, "Geotechnical Engineering", Universities Press.,
5. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.
7. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

## HYDROLOGY AND IRRIGATION ENGINEERING

| | | | |
|---|---|---|---|
| Course Code | **18CV63** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:2:0) | SEE Marks | 60 |
| Credits | 04 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

**Module -1**

**Hydrology:** Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

**Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

**Module -2**

**Losses: Evaporation:** Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.

**Evapo-transpiration:** Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation.

**Infiltration:** Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

**Module -3**

**Runoff:** Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

**Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.

**Module -4**

**Irrigation:** Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.

**Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

**Module -5**

**Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

**Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

**Course outcomes:** After studying this course, students will be able to:
1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.

4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

**Reference Books:**

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**MATRIX METHOD OF STRUCTURAL ANALYSIS**

| | | | |
|---|---|---|---|
| Course Code | **18CV641** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses.
3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.
4. Gain knowledge of solving problems involving temperature changes and lack of fit.

**Module -1**

**Introduction:** Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements.

**Module -2**

**Element Flexibility Method:** Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

**Module -3**

**Element Stiffness Method:** Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

**Module -4**

**Effects of Temperature Changes and Lack of Fit:** Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

**Module -5**

**Direct Stiffness Method:** Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses.

**Course Outcomes:** After studying this course, students will be able to:
1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
4. Evaluate secondary stresses.

**Question paper pattern:**
**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Weaver W and Gere J H, **“Matrix Analysis of Framed Structures”**, CBS publications, New Delhi.
2. Rajasekaran S, **“Computational Structural Mechanics”**, PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **“Matrix and Finite Element Analysis of Structures”**, Ane Books Pvt. Ltd.


**Reference Books:**

1. Godbole P N et.al, “Matrix Method of Structural Analysis”, PHI ltd, New Delhi.
2. Pundit and Gupta, “Theory of Structures Vol II”, TMH publications, New Delhi
3. A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee.
4. Manikaselvam, “Elements of Matrix Analysis and Stability of Structures”, Khanna Publishers, New Delhi.
5. H C Martin, “Introduction to Matrix Methods in Structural Analysis”, International textbook company, McGraw Hill.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**SOLID WASTE MANAGEMENT**

| | | | |
|---|---|---|---|
| Course Code | **18CV642** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

**Module -1**

**Sources:** Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.
**Collection:** Collection of solid waste- services and systems, equipments,
Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.

**Module -2**

Processing techniques: Purpose of processing, Volume reduction by incineration, Process description, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

**Module -3**

**Composting Aerobic and anaerobic method** - process description, process microbiology, design consideration, Mechanical composting, Vermi composting, Numerical Problems.
**Sanitary land filling:** Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems.

**Module -4**

**Sources, collection, treatment and disposal**:- Biomedical waste,E-waste, construction and demolition waste.

**Module -5**

Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolsis , Energy recovery technique from solid waste management. Hazardous waste.

**Course outcomes:** After studying this course, students will be able to:
1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

| |
|---|
| 1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, “Integrated Solid Waste Management : Engineering principles and management issues”, M/c Graw hill Education . Indian edition<br>2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co ltd., |
| **Reference Books:** |
| 1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016<br>2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health and Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.<br>**3.** Handbook of Solid waste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231 |

| B. E. CIVIL ENGINEERING<br>**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**<br>**SEMESTER - VI** | | | |
|---|---|---|---|
| **ALTERNATE BUILDING MATERIALS** | | | |
| Course Code | **18CV643** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

**Module -1**

**Introduction:** Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.

**Module -2**

**Elements of Structural Masonry :** Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

**Structural Masonry Mortars:** Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

**Module -3**

**Alternate Building Materials:** Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

**Module -4**

**Alternate Building Technologies:** Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications.

Top down construction, Mivan Construction Technique.

**Alternate Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

**Module -5**

**Equipment for Production of Alternate Materials:** Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

**Course Outcomes:** After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International pub.
2. Arnold W Hendry, “Structural Masonry”, Macmillan Publishers.

**Reference Books:**

1. RJS Spence and DJ Cook, “Building Materials in Developing Countries”, Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VI | | | |
|---|---|---|---|
| **GROUND IMPROVEMENT TECHNIQUES** | | | |
| Course Code | **18CV644** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geo synthetics, vibration, grouting and Injection.

**Module -1**

**Formation and Development of Ground :** Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits; Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.

**Compaction:** Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.

**Module -2**

**Drainage Methods:** Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.

**Pre-compression and Vertical Drains:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

**Module -3**

**Chemical Modification-I:** Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.

**Chemical Modification-Ii:** Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

**Module -4**

**Vibration Methods:** Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibro flotation, sand compaction piles, stone columns, heavy tamping

**Grouting And Injection**: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

**Module -5**

**Geosynthetics:** Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,

**Miscellaneous Methods (Only Concepts & Uses):** Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.

**Course Outcomes:** After studying this course, students will be able to:

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.

- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Purushothama Raj P, “Ground Improvement Techniques”, Laxmi Publications, New Delhi.
2. Koerner R.M, “Construction and Geotechnical Method in Foundation Engineering”, McGraw Hill Pub. Co.

**Reference Books:**

1. Bell, F.G., “Methods of treatment of unstable ground”, Butterworths, London.
2. Nelson J.D. and Miller D.J, “Expansive soils”, John Wiley and Sons.
3. Ingles. C.G. and Metcalf J.B , “Soil Stabilization; Principles and Practice”, Butterworths
4. Manfred Hausmann , “Engineering principles of ground modification”, McGraw Hill Pub. Co.,

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS**

| | | | |
|---|---|---|---|
| Course Code | **18CV645** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
2. Learndifferenttypesofstructuralcomponents,engineeringpropertiesofthematerials,tocalculatethematerial quantities required for construction
3. Understand various aspects of geometrical elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels, harbors, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

**Module-1**

**Railway Planning:** Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way
– Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings(Explanation & Sketches of Right and Left hand turnouts only).

**Module-2**

**Railway Construction and Maintenance:** Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

**Module-3**

**Harbour and Tunnel Engineering:** Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design
Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.
Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

**Module-4**

**Airport Planning:** Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

**Module-5**

**Airport Design:** Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements ofTaxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

**Course outcomes:** After studying this course, students will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbook:**


1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M. M,"Railway Engineering", 2nd Edition, Oxford University Press,New Delhi.
3. Khanna S K, Arora M G and Jain S S,"Airport Planning and Design", Nemch and and Brothers, Roorkee.
4. CVenkatramaiah,"TransportationEngineering",VolumeII:Railways,Airports,DocksandHarbours,Bridgesand Tunnels, Universities Press.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.


**Reference Books:**


1. Oza.H.P.andOza.G.H.,"AcourseinDocks&HarbourEngineering".Charotar Publishing Co.,
2. Mundrey J. S. "A course in Railway Track Engineering".Tata Mc Graw Hill.
3. Srinivasan R. Harbour," Dock and TunnelEngineering",26thEdition2013.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

## REMOTE SENSING AND GIS

| | | | |
|---|---|---|---|
| Course Code | **18CV651** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required units.
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic camps for various applications.

**Module-1**

**Remote Sensing:** Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

**Module-2**

**Remote Sensing Platforms and Sensors:** Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude), Image enhancements(Gray Level Thresholding, level slicing, contrast stretching),image filtering.

**Module-3**

**Geographic Information System**: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

**Module-4**

**Data Models:** Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, and Data conversion.

**Module-5**

**Integrated Applications of Remote sensing and GIS:** Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications.

**Course outcomes:** After studying this course, students will be able to:

1. Collectdataanddelineatevariouselementsfromthesatelliteimageryusingtheirspectralsignature.
2. Analyze different features of ground information to create raster or vector data.
3. Perform digital classificationandcreatedifferentthematicmapsforsolvingspecificproblems
4. Make decision based on the GIS analysis on thematic maps.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press2011
3. Kang – T surg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited2015.
4. Lilles and, Kiefer, Chipman,"RemoteSensingandImageInterpretation",Wiley2011.

**Reference Books:**

1. Chor Pang Lo and Albert K.W Yeung, "Concepts &Techniques of GIS", PHI,2006
2. John R. Jensen, "Remote sensing of the environment", an earth resources perspective–2nd edition–by Pearson Education2007.
3. Anji Reddy M., "Remote sensing and Geographical information system", B. S. Publications2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications2004.
5. S Kumar,"Basics of remote sensing & GIS", Laxmi publications 2005.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**TRAFFIC ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV652** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analyzing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

**Module-1**

**Traffic Planning and Characteristics**: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

**Module-2**

**Traffic Surveys:** Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service-Concept, applications and significance.

**Module-3**

**Traffic Design and Visual Aids:** Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.

**Module-4**

**Traffic Safety and Environment**: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

**Module-5**

**Traffic Management:** Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

**Course outcomes:** After studying this course, students will be able to:
1. Understandthehumanfactorsandvehicularfactorsintrafficengineeringdesign.
2. Conductdifferenttypesoftrafficsurveysandanalysisofcollecteddatausingstatisticalconcepts.
3. Useanappropriatetrafficflowtheoryandtocomprehendthecapacity&signalizedintersectionanalysis.
4. Understand the basic knowledge of Intelligent Transportation System.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Kadiyali. L.R. “Traffic Engineering and Transport Planning ”, Khanna Publishers, Delhi,2013
2. S K Khanna and CEG Justo and AVeeraragavan, “Highway Engineering”, Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B, “Highway Traffic Analysis and design”, Macmillan PressLtd.1996.

**Reference Books:**

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi,2011.
2. GarberandHoel,“PrinciplesofTrafficandHighwayEngineering”,CENGAGELearning,NewDelhi,2010.
3. SP: 43-1994,IRCSpecification,“Guidelineson Low-cost Traffic Management Techniques” for Urban Areas,1994.
4. John E Tyworth, “Traffic Management Planning, Operations and control”, Addison Wesly Publishing Company, 1996.
5. Hobbs.F.D.“Traffic Planning and Engineering”,University of Brimingham,Peragamon Press Ltd,2005.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**OCCUPATIONAL HEALTH AND SAFETY**

| | | | |
|---|---|---|---|
| Course Code | **18CV653** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Gainan historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify work place problems and safe work practice

**Module-1**

**Occupational Hazard and Control Principles:** Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.

**Module-2**

**Ergonomics at Work Place:** Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.

**Module-3**

**Fire Prevention and Protection:** Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.
**Electrical Safety, Product Safety:** Technical Requirements of Product safety.

**Module-4**

**Health Considerations at Work Place:** types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability.

**Module-5**

**Occupational Health and Safety Considerations:** Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

**Course outcomes:** After studying this course, students will be able to:
1. Identifyhazardsintheworkplacethatposeadangerorthreattotheirsafetyorhealth,orthatofothers.
2. Controlunsafeorunhealthyhazardsandproposemethodstoeliminatethehazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Goetsch D. L.,(1999), “Occupational Safety and Health for Technologists, Engineers and Managers”,

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|---|
| Prentice Hall.<br>2. HeinrichH.W.,(2007),“IndustrialAccidentPrevention-AScientificApproach”,McGraw-HillBookCompany<br>National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),<br>3. “Industrial Safety and Pollution Control Handbook. |
| **Reference Books:** |
| 1. CollingD.A.,(1990),“IndustrialSafetyManagementandTechnology”,PrenticeHall,New Delhi.<br>2. Della D.E., and Giustina, (1996), “Safety and Environmental Management”, Van Nostrand Reinhold International Thomson Publishing Inc. |

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**SUSTAINABILITY CONCEPTS IN CIVIL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV654** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Learn about the principles, indicators and general concept of sustainability.
2. Apprehend the local, regional and global impacts of unsustainable designs, products and processes.
3. Student shall be able to apply the sustainability concepts in engineering
4. Know built environment frame work sand their use
5. Understand how building and design is judged and valued by clients and stakeholders and how to implement sustainability.

**Module-1**

**Introduction:** Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.

**Module-2**

**Global Environmental Issue:** Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking.

**Module-3**

**Sustainable Design:** Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

**Module-4**

**Clean Technology and Energy:** Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

**Module-5**

**Green Engineering:** Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

**Course Outcomes:** After studying this course, students will be able to:

1. Learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development.
2. Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
3. Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.
4. Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Allen, D.T. and S honnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo, A. O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.


**Reference Books:**


1. Mackenthun, K. M.,Basic Concepts in Environmental Management, Lewis Publication.
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System.
3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice.
6. Daniel A. Vallero and Chris Brasier, “Sustainable Design: The Science of Sustainability and Green Engineering”, Wiley-Blackwell.
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers.

# INTELLIGENT TRANSPORTATION SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]

**SEMESTER – VI**

| | | | |
|---|---|---|---|
| Subject Code | **18CV655** | CIE Marks | 40 |
| Number of Lecture Hours/Week(L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:** This course will enable students to

Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control. Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travellers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate commercial fleets and freight exchange, and automate driving and safety.

**Module -1**

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic InformationSystems (GIS), video data collection.

**Module -2**

Advanced traveller information systems; transportation network operations; commercial vehicle operations and intermodal freight.

**Module -3**

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

**Module -4**

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS andsustainable mobility.

**Module -5**

Travel demand management, electronic toll collection, and ITS and road-pricing.Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITSImplementations in developed countries, ITS in developing countries.

**Course outcomes:**

After studying this course, students would be able to suggest the appropriate system/s in various functional areas of transportation. Would be able to amalgamate the various systems, plan and implement the applications of ITS. Wouldhave learnt the application of information technology and telecommunication to control traffic and alsoprovide advance information to the travellers, automatic handling of emergencies and to improve safety.

**Graduate Attributes (as per NBA)**

- *Scholarship of Knowledge.*
- *Critical thinking.*
- *Ethical practices and social responsibility*
- *Use of modern tools*

**Question paper pattern:**

1. The question paper will have tenquestions.
2. Each full question consists of 20marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under amodule.
5. The students will have to answer 5 full questions, selecting one full question from each module.

**Text Book:**

1. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House.
2. Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Publishers

**Reference Books:**

1. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS Hand Book 2000.
2. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.
3. US Department of Transportation, "National ITS Architecture Documentation", 2007 (CDROM).
4. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", Prentice Hall

# CONSERVATION OF NATURAL RESOURCES

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

**SEMESTER – VI**

| | | | |
|---|---|---|---|
| Subject Code | **18CV656** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course learning objectives: T**his course will enable the students to

- Learn types of land forms , soil conservation and sustainable land use planning.
- Apprehend water resources, types, distribution, planning and conservation.
- Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control.
- Apprehend basics of biodiversity and ecosystems.
-

**Module -1**

Land: Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.

**Module -2**

Water: Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

**Module -3**

Air: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, smoke and its control. Ozone depletion –impacts, photochemical changes.

Minerals and rocks: Minerals, important rock forming minerals like Quartz, Mica, Feldspar and Amphibole, lithification & metamorphism, weathering: physical, biogeochemical processes, erosion, agents of erosion.

**Module -4**

Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry. Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of eco system.

**Module -5**

Global warming: concept, indicators, factors and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity.

EIA: Regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects.

**Course Outcomes(CO):**

At the end of the course, students will be able to

1. Apprehend various components of land as a natural resource and land use planning.
2. Know availability and distribution for water resources as applied to India.
3. Analyse the components ofair as resource and its pollution.
4. Discuss biodiversity & its role in ecosystem functioning.
5. Critically appreciate the environmental concerns of today.

**Question paper pattern:**

1. The question paper will have ten questions, carrying equal marks.
2. There will be two full questions with a maximum four sub questions from each module. Students shall answer five full questions selecting one full question from each module.

**Text Books:**


1. Modi, P.N., "Irrigation Water Resources and Water Power Engineering". Standard Book House, New Delhi. 10th Edition, 2019.
2. Raghunath, H.M., "Groundwater",3rd Edition, New Age International Publishers, New Delhi, 2007.
3. Krishnan, M.S., "Geology of India & Burma". CBS publishers, New Delhi, 2017.
4. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011.
5. M N Rao and H V N Rao, "Air pollution", McGraw Hill Publications, 2017.
6. Krishnamurthy K.V., "An advanced textbook of Biodiversity- Principle &Practices." Oxford and IBH publications, New Delhi. 2004.


**Reference Books :**


1. Odum, E.P., "Fundamentals of Ecology", W.B sounders, Philadelphia, USA, 1971
2. Singh J.S, Singh S.P & Gupta, S.R.,"Ecology, environment and resource conservation",Anamayapublications, 2006.
3. Edmond A. Mathez & Jason E. Smerdon, "Climate Change: The science of Global warming and our energy feature", Columbia University Press, 2009.
4. National Council of Applied Economic Research, "Economic Impact of Interlinking of Rivers Program", Revised Final Report, April 2008.
5. http://nwda.gov.in/content.
6. Madhav Gadagil, "Biodiversity and India's degraded lands", Indian Academy of Sciences, Volume 22- No 2/3, http://www.jstor.org/pss/4314063

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**SOFTWARE APPLICATION LABORATORY**

| | | | |
|---|---|---|---|
| Course Code | **18CVL66** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Use industry standard software in a professional set up.
2. Understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design.
3. Develop customized automation tools.

**Module -1**

**Use of civil engineering software's:**

Use of software's for:

1. Analysis of plane trusses, continuous beams, portal frames.
2. 3D analysis of multistoried frame structures.

**Module -2**

1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:**

a. Understanding basic features of Project management software
b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
c. Identification of Predecessor and Successor activities with constrain
d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Othernon Critical paths, Project duration, Floats.
e. Study on various View options available
f. Basic understanding about Resource Creation and allocation
g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project

1. **GIS applications using open source software:**

a. To create shape files for point, line and polygon features with a map as reference.
b. To create decision maps for specific purpose.

**Module -3**

**Use of EXCEL spread sheets:**

Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation.

**Course Outcomes:** After studying this course, students will be able to:

use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

**Question paper pattern:**

- The question paper will have 6 questions under 3 modules.
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics under a module.
- Module-1: 40 Marks, Module-2: 30 Marks, Module-3: 30 Marks.
- The students shall answer three full questions, selecting one full question from each module.

**Reference Books:** Training manuals and User manuals and Relevant course reference books

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**ENVIRONMENTAL ENGINEERING LABORATORY**

| | | | |
|---|---|---|---|
| Course Code | **18CVL67** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students,

1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

1. Preparation chemical solutions required for analysis and sampling methodologies
2. Determination of pH, Conductivity, TDS and Turbidity.
3. Determination of Acidity and Alkalinity
4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen
6. Determination of BOD.
7. Determination of Chlorides
8. Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.
9. Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids.
10. Determination of optimum coagulant dosage using Jar test apparatus.
11. Determination Nitrates and Iron by spectrophotometer
12. Determination of COD(Demonstration)
13. Air Quality Monitoring (Demonstration)
14. Determination of Sound by Sound level meter at different locations (Demonstration)

**Course Outcomes:** After studying this course, students will be able to:

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

**Question paper pattern:**

- Two experiments shall be asked from the above set of experiments.
- One experiment to be conducted and for the other student should write detailed procedure.

**Reference Books:**

1. IS codes-3025 series
2. Standard method for examination of water and waste water, APHA, 20$^{th}$ edition
3. Clair Sawyer and Perry McCarty and Gene Parkin, “Chemistry for Environmental Engineering and Science”, McGraw-Hill Series in Civil and Environmental Engineering.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VI**

**EXTENSIVE SURVEY PROJECT**

| | | | |
|---|---|---|---|
| Course Code | **18CVEP68** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Total Number of Practice Hours | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

**Note:**

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. **NEW TANK PROJECTS:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design and preparation of drawing with report.
2. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparation of village map by using total station.
   d. Survey work required for laying of water supply and UGD
   e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   f. Design of all elements and preparation of drawing with report.
3. **HIGHWAY PROJECT:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
   d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.
4. **RESTORATION OF AN EXISTING TANK:** The work shall consist of;
   a. Reconnaissance survey for selection of site and conceptualization of project.
   b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
   c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   d. Design of all elements and preparation of drawing with report.

5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Detailed survey required for project execution like contour surveys
c. Preparation of layout plans as per regulations
e. Centerline marking-transfer of centre lines from plan to ground
f. Design of all elements and preparation of drawing with report as per regulations

**Course outcomes:** After studying this course, students will be able to:

1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

**Reference Books:**

Training manuals and User manuals
Relevant course reference books

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

**QUANTITY SURVEYING AND CONTRACT MANAGEMENT**

| | | | |
|---|---|---|---|
| Course Code | **18CV71** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;
1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project
2. Understand and apply the concept of Valuation for Properties
3. Understand, Apply and Create the Tender and Contract document.

**Module -1**

**Quantity Estimation for Building:** study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centre line method.
Estimate of R.C.C structures including Slab, beam, column, footings.

**Module -2**

Estimate of Steel truss, manhole and septic tanks and slab culvert.
**Quantity Estimation for Roads:** Computation of volume of earthwork fully in banking, cutting, partly cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.

**Module -3**

**Specification for Civil Engineering Works:** Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads.
**Analysis of Rates :** Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost
Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

**Module-4**

**Contract Management-Tender and its Process:** Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).
Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture.
**Contract Forms:** FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC.

**Module -5**

**Contract Management-Post award :**Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, **Disputes & its resolution mechanism,** Contract management and administration.
**Valuation:** Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.

**Course outcomes:** After studying this course, students will be able to:
1. Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.
2. Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works.
3. Prepare the specifications and analyze the rates for various items of work.
4. Assess contract and tender documents for various construction works.
5. Prepare valuation reports of buildings.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.

- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Datta B.N., “Estimating and costing”, UBSPD Publishing House, New Delhi.
2. B.S. Patil, “Civil Engineering Contracts and Estimates”, Universities Press.
3. M. Chakraborthi; “Estimation, Costing and Specifications”, Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.


**Reference Books:**


1. Kohli D.D and Kohli R.C, “Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, “Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor’s Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , “ Estimating Construction Costs” – 5ed , Tata McGraw-Hill , New Delhi.
7. David Pratt, “Fundamentals of Construction Estimating” – 3ed, Edition.
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.
9. B.S. Ramaswamy “Contracts and their Management” 3ed, Lexis Nexis(a division of Reed Elsevier India Pvt Ltd).

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

**DESIGN OF RCC AND STEEL STRUCTURES**

| | | | |
|---|---|---|---|
| Course Code | **18CV72** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
2. Identify, formulate and solve engineering problems in RC and Steel Structures
3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

**Module -1**

**Footings:** Design of rectangular slab, slab-beam type combined footing.
Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.
**Water Tanks:** Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV).**
Design of portal frames with fixed and hinged based supports.

**Module -2**

**Roof Truss:** Design of roof truss for different cases of loading, forces in members to given.
**Plate Girder:** Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks
**Gantry Girder:** Design of gantry girder with all necessary checks.

**Course Outcomes:** After studying this course, students will be able to:

1. Students will acquire the basic knowledge in design of RCC and Steel Structures.
2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

**Question Paper Pattern:**

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 50 marks.
- Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination.

**Textbooks:**


1. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
2. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
3. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi


**Reference Books:**


1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behavior"**, Pearson Publications
2. Nether Cot, et.al, **"Behavior and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

## THEORY OF ELASTICITY

| | | | |
|---|---|---|---|
| Course Code | **18CV731** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials in to more general, two and three-dimensional problems.
2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
3. Introduction to the stress–strain relationship, basic principles and mathematical expressions involved in continuum mechanics. Also solution of problems in 2-dimensional linear elasticity.

**Module-1**

Rigid and deformable bodies, body and surface forces, concept of stress, state of stress at a point, Cartesian stress components, Cauchey's stress formula, stress transformation, principal stresses and principal planes, stress invariants, equations of equilibrium in 2D and 3D (Cartesian coordinates).

**Module-2**

Types of strain, strain displacement relations, state of strain at a point, strain tensor, strain transformation, strain along a linear element, principal strains, strain invariants, octahedral strains, spherical and deviatoric strains.

**Module-3**

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). Equations of equilibrium in polar coordinate, compatibility equation, stress function.

**Module-4**

Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

**Module-5**

**Torsion:** Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections.

**Course outcomes:** After studying this course, students will be able to:
1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum.
2. Ability to formulate boundary value problems; and calculate stresses and strains.
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints.
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**
1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 2012.
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford &IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003.

**Reference Books:**
1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York,1953.
2. G. W. Housner and T. Vreeland, Jr., "The Analysis o f Stress and Deformation", California Institute of Tech., CA, 2012.[Downloadasperuserpolicyfromhttp://resolver.caltech.edu/CaltechBOOK:1965.001].
3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", PrenticeHall,2003.
4. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press,1998.

| B. E. CIVIL ENGINEERING<br>**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**<br>**SEMESTER - VII** | | | |
|---|---|---|---|
| **AIR POLLUTION AND CONTROL** | | | |
| Course Code | **18CV732** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Study the sources and effects of air pollution
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models
4. Illustrate particular and gaseous pollution control methods.

**Module-1**

**Introduction:** Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.

**Module-2**

**Meteorology:** Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.

**Module-3**

**Sampling:** Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5}$, $PM_{10}$, $SO_X$, $NO_X$, CO, $NH_3$). Development of air quality models-Gaussian dispersion model-Including Numerical problems.

**Module-4**

**Control Techniques:** Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP - Including Numerical problems. Site selection for industrial plant location.

**Module-5**

Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes. Environmental laws and acts.

**Course outcomes:** After studying this course, students will be able to:

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication.
3. Mackenzie Davis and David Cornwell, “Introduction t o Environmental Engineering” McGraw-Hill Co.


**Reference Books:**


1. Noel De Nevers, “Air Pollution Control Engineering”, Waveland Pr Inc.
2. Anjaneyulu Y, “Text book of Air Pollution and Control Technologies”, Allied Publishers.

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VII | | | |
|---|---|---|---|
| **PAVEMENT MATERIALS AND CONSTRUCTION** | | | |
| Course Code | **18CV733** | CIE Marks | 40 |
| Teaching Hours/Week | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

1. Expose students to different materials which are used in pavement construction, impart knowledge about the engineering properties required.
2. To train students to perform various types of bituminous mix designs as per the guidelines (MORTH).
3. Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field scenarios.
4. Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).
5. To introduce students to possible improvisation in various layers of pavement to increase the structural strength by the use of non basic materials (DLC, polythene sheets).

**Module-1**

**Pavement Materials**

**Aggregates-** Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.

**Bitumen and Tar-** Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements.

**Module-2**

**Bituminous emulsion and Cutbacks-** Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion.

**Module-3**

**Bituminous mixes:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveemstabilo meter and Hubbar- field tests) bituminous mixes, Design methods using Rothfutch's method only and specification, Marshall mix design criteria, voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above.

**Module-4**

**Equipments in highway construction:** Various types of equipments for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

**Sub grade:** Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests.

**Module-5**

**Flexible Pavements:** Specifications of materials, Construction method and field control checks for various types of flexible pavement layers.

**Cement Concrete Pavements:** Specifications and method of cement concrete pavement construction (PQC, importance of providing DLC as sub base and polythene thin layer between PQC and sub base). Quality control tests, Construction of various types of joints.

**Course outcomes:** At the end of the course the student will be able to:

1. Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
2. Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
3. Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
4. Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2. Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

**Reference Books**

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT& H specifications.

**Web links and Video Lectures:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

## GROUND WATER HYDRAULICS

| | | | |
|---|---|---|---|
| Course Code | **18CV734** | IA Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | Exam Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students
1. To characterize the properties of ground water and aquifers.
2. To quantify the ground water flow.
3. To locate occurrence of ground water and augment ground water resources.
4. To synthesize ground water development methods.

**Module -1**

**Introduction:** Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.

**Module -2**

**Fundamentals of Ground Water Flow:** Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, anisotropic layered soils.

**Module -3**

**Well Hydraulics:** Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leakyaquifers (only introduction), interference of well, image well theory.

**Module -4**

**Ground Water Exploration:** Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.

**Module -5**

**Ground Water Development:** Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.
**Ground Water Recharge:** Artificial recharge, Rainwater harvesting for ground water recharge.

**Course outcomes:** After studying this course, students will be able to:
1. Find the characteristics of aquifers.
2. Estimate the quantity of ground water by various methods.
3. Locate the zones of ground water resources.
4. Select particular type of well and augment the ground water storage.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.


**Reference Books:**

1. GargSatyaPrakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

## MASONRY STRUCTURES

| | | | |
|---|---|---|---|
| Course Code | **18CV735** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

**Module-1**

**Masonry Units, Materials, types and masonry construction**: Bricks, Stone and Block masonry units-strength, modulus of elasticity and water absorption of masonry materials–classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.
**Strength and Stability:** Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

**Module-2**

**Permissible stresses:** Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.
**Design Considerations:** Effective height of wall sand columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

**Module-3**

**Load considerations and design of Masonry subjected to axial loads:** Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

**Module-4**

**Design of walls subjected to concentrated axial loads:** Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.
**Design of walls subjected to eccentric loads:** Design criteria – stress distribution under eccentric loads –Problems onec centrically loaded solid walls, cavity walls, walls with piers.

**Module-5**

**Design of Laterally and transversely loaded walls:** Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.
Introduction to reinforced brick masonry, lintels and slabs.
In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

**Course outcomes:** After studying this course, students will be able to:

1. Select suitable material for masonry construction by understanding engineering properties.
2. Compute loads, load combinations and analyze the stresses in masonry.
3. Design masonry under compression (Axial load) for various requirements and conditions.
4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
5. Assess the behavior of shear wall and reinforced masonry.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Dayaratnam P, “Brick and Reinforced Brick Structures”, Scientific International Pvt. Ltd.
2. M. L. Gambhir, “Building and Construction Materials”, McGraw Hill education Pvt. Ltd.

**Reference Books:**

1. Henry, A.W., “Structural Masonry”, Macmillan Education Ltd.,1990.
2. IS 1905–1987 “Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.
3. SP20(S&T)–1991,“Hand book on masonry design and construction(1$^{st}$revision) BIS, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

## EARTHQUAKE ENGINEERING

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|---|---|---|---|
| Course Code | **18CV741** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

**Module -1**

**Engineering Seismology:** Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake).

**Module -2**

**Response Spectrum:** Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

**Module -3**

**Seismic Performance of Buildings and Over View of IS-1893 (Part-1):** Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

**Module -4**

**Determination of Design Lateral Forces:** Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

**Module -5**

**Earthquake Resistant Analysis and Design of RC Buildings:** Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings

**Earthquake Resistant Design of Masonry Buildings:** Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

**Course outcomes:** After studying this course, students will be able to:

1. Acquire basic knowledge of engineering seismology.
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry

structures thorough exposure to different IS-codes of practices.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
2. S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
3. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
4. T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

**Reference Books:**

1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

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| **B. E. CIVIL ENGINEERING**<br>**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**<br>**SEMESTER - VII** | | | |
| **DESIGN CONCEPT OF BUILDING SERVICES** | | | |
| Course Code | **18CV742** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Learn the importance of sanitation, domestic water supply, and plumbing and fire services.
2. Understand the concepts of heat, ventilation and air conditioning.
3. Develop technical and practical knowledge in Building Services.

**Module -1**

**Water Supply and its Services.**

Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom–taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit.

**Module -2**

**Heat Ventilation and Air Conditioning (HVAC):**

Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

**Module -3**

**Electrical and Fire Fighting Services:**

Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice, planning electrical wiring for building, Main and distribution boards, Principles of illumination.

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC.

**Module -4**

**Plumbing and Fire Fighting Layout of Simple Buildings:**

Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

**Module -5**

**Engineering Services:** engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.

Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

**Building Maintenance**: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

**Course Outcomes:** After studying this course, students will be able to:

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Reference Books:**


1. National Building Code.
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & D L Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
4. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
5. M. David Egan, Concepts in Building Fire Safety.
6. O. H. Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom.
7. V. K. Jain, Fire Safety in Building 2edition, New Age International Publishers.
8. E. G. Butcher, Smoke control in Fire-safety Design.
9. E. R. Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York.
10. Handbook for Building Engineers in Metric systems, NBC, New Delhi.

| B. E. CIVIL ENGINEERING<br>**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**<br>**SEMESTER - VII** | | | |
|---|---|---|---|
| **REINFORCED EARTH STRUCTURES** | | | |
| Course Code | **18CV743** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;

1. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

**Module -1**

**Basics of Reinforced Earth Construction:** Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

**Geosynthetics and Their Functions:** Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics.

**Properties and Tests on Materials** Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.

**Module -2**

**Design of Reinforced Earth Retaining Walls:** Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

**Soil Nailing Techniques:** Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

**Module -3**

**Design of Reinforced Earth Foundations:** Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

**Module -4**

**Geosynthetics for Roads and Slopes:** Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes.

**Module -5**

**Geosynthetics - filter, drain and landfills:** Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti clogging, survivability and durability (No Numerical Problems)

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems).

**Course outcomes:** After studying this course, students will be able to:

1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geo synthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geo synthetics in drainage requirements and landfill designs

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Koerner. R.M, "Design with Geo synthetics", Prince Hall Publications
2. Koerner. R.M. &Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York,.
3. Sivakumar Babu G. L., "An introduction to Soil Reinforcement and Geo synthetics", Universities Press, Hyderabad
4. Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, "Engineering with Geo synthetics", Tata McGraw Hill publishing Company Limited., New Delhi.


**Reference Books:**


1. Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, "Ground Engineer's reference Book", Butter worths, London
5. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.
6. Sarsby R W- Editor, "Geo synthetics in Civil Engineering", Wood head Publishing Ltd & CRC Press, 2007

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VII | | | |
|---|---|---|---|
| **DESIGN OF HYDRAULIC STRUCTURES** | | | |
| Course Code | **18CV744** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |
| **CREDITS –03** | | | |

**Course Learning Objectives:** This course will enable students to;

1. Analyze and design gravity dams.
2. Find the cross-section of earth dam and estimate the seepage loss.
3. Design spillways and aprons for diversion works.
4. Design CD works and chose appropriate canal regulation works.

**Module -1**

**Gravity Dams:** Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.

**Module -2**

**Earth Dams:** Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.

**Module -3**

**Spillways:** Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices.
**Diversion Headworks:** Design of aprons- Bligh's and Koshla's theory, Simple Problems.

**Module -4**

**Cross Drainage Works:** Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.

**Module -5**

**Canal Regulation Works:** Introduction, Function of a regulator.
**Canal falls:** Necessity and types.
**Canal outlets:** Necessity and types.

**Course outcomes:** After studying this course, students will be able to:

1. Check the stability of gravity dams and design the dam.
2. Estimate the quantity of seepage through earth dams.
3. Design spillways and aprons for various diversion works.
4. Select particular type of canal regulation work for canal network.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. Punmia and Pandey Lal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3. K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard Publications, New Delhi.

**Reference Books:**

1. R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, New Delhi.
2. P. N. Modi, "Irrigation, Water Resources and Water Power", Standard Book House, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

**URBAN TRANSPORT PLANNING**

| | | | |
|---|---|---|---|
| Course Code | **18CV745** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;

5. Understand and apply basic concepts and methods of urban transportation planning.
6. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
7. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
8. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

**Module -1**

**Urban transport planning:** Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

**Module -2**

**Data Collection And Inventories:** Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

**Module -3**

**Trip Generation & Distribution**: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above.**

**Module -4**

**Trip Distribution**: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above.**

**Module -5**

**Traffic Assignment:** Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.

**Course outcomes:** After studying this course, students will be able to:

5. Design, conduct and administer surveys to provide the data required for transportation planning.
6. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
7. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
8. Adopt the steps that are necessary to complete a long-term transportation plan.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

4. Kadiyali. L. R., ‘Traffic Engineering and Transportation Planning’, Khanna Publishers, New Delhi.
5. Hutchinson, B.G, ‘Introduction to Urban System Planning’, McGraw Hill.
6. Khisty C.J., ‘Transportation Engineering – An Introduction’ Prentice Hall.
7. Papacostas, ‘Fundamentals of Transportation Planning’, Tata McGraw Hill.

**Reference Books:**

3. Mayer M and Miller E, ‘Urban Transportation Planning: A decision oriented Approach’, McGraw Hill.
4. Bruton M.J., ‘Introduction to Transportation Planning’, Hutchinson of London.
5. Dicky, J.W., ‘Metropolitan Transportation Planning’, Tata McGraw Hill.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

**FINITE ELEMENT METHOD**

| | | | |
|---|---|---|---|
| Course Code | **18CV751** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;
1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

**Module -1**

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.

**Module -2**

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.

**Module -3**

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisym metric Element.

**Module -4**

Isopara metric concepts; is opera metric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isopara metric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.

**Module -5**

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.
Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

**Course outcomes:** The student will have the knowledge on advanced methods of analysis of structures.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**
1. Krishnamoorthy C.S., “Finite Element analysis” -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al. “Concepts and applications of Finite Element analysis”, John Wiley.

**Reference Books:**
1. Daryl L Logan, “A first course on Finite element Method”, Cengage Learning.
2. Bathe K J - “Finite Element Procedures in Engineering analysis”- Prentice Hall.

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| **B. E. CIVIL ENGINEERING**<br>**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**<br>**SEMESTER - VII** | | | |
| **NUMERICAL METHODS AND APPLICATIONS** | | | |
| Course Code | **18CV752** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

**Module -1**

**Solution of Equations and Eigen value Problems:** Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method.

**Module -2**

**Interpolation and Approximation:** Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

**Module -3**

**Numerical Differentiation and Integration:** Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**Module -4**

**Initial Value Problems for Ordinary Differential Equations :** Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

**Module -5**

**Boundary Value Problems in Ordinary and Partial Differential Equations:**
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

**Course Outcomes:** After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi.

**Reference Books:**

1. Chapra. S.C. and Canale. R. P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi.
2. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi.

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VII | | | |
|---|---|---|---|
| **ENVIRONMENTAL PROTECTION AND MANAGEMENT** | | | |
| Course Code | **18CV753** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to gain knowledge in Environmental protection and Management systems

**Module -1**

**Environmental Management Standards**: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

**Module -2**

**Environmental Management Objectives**: Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.

**Module -3**

**Environmental Management System**: EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

**Module -4**

**Environmental Audit**: Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.

**Module -5**

**Applications:** Applications of EMS, Waste Audits and Pollution Prevention Control: Textile, Sugar, Pulp & Paper, Electroplating, , Tanning industry. Hazardous Wastes - Classification, characteristics Treatment and Disposal Methods, Transboundary movement, disposal.

**Course outcomes:** After studying this course, students will be able to:

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards.
2. Lead pollution prevention assessment team and implement waste minimization options.
3. Develop, Implement, maintain and Audit Environmental Management systems for Organizations.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Reference Books:**


1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International

Organisation for Standardisation, 2004
3. ISO 19011: 2002, “Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

**COMPUTER AIDED DETAILING OF STRUCTURES**

| | | | |
|---|---|---|---|
| Course Code | **18CVL76** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

**Module -1 Detailing of RCC Structures**

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

**Module -2 Detailing of Steel Structures**

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Welded Plate girder
6. Gantry Girder

**Course outcomes:** After studying this course, students will be able to:
- Prepare detailed working drawings

**Question paper pattern:**
1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 50 marks.

**Textbooks:**

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi


**Reference Books:**

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards.
2. IS 13920, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VII**

## GEOTECHNICAL ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| Course Code | **18CVL77** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (0:2:2) | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;
1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

**Modules**

1. Field identification of soil, Specific gravity test (pycnometer and density bottle method).Water content determination by oven drying and Pycnometer method, rapid moisture meter method.
2. Grain size analysis
   i. Sieve analysis
   ii. Hydro meter analysis
3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method
4. Consistency limits
   i. Liquid limit test(by Casagrande's and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test
5. Standard compaction test (light and heavy compaction)
6. Co-efficient of permeability test
   i. Constant head test
   ii. Variable head test
7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (unconsolidated undrained test only)
8. Consolidation test :To determine pre consolidation pressure only(half an hour per loading-test).
9. Laboratory vane shear test
10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

**Course outcomes:** Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine
1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shearstrengthandconsolidationparameterstoassessstrengthanddeformationcharacteristics
5. In-situshear strength characteristics(SPT-Demonstration)

**Question paper pattern:**
- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him.
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

**Reference Books:**

1. Punmia B C, Soil Mechanics and Foundation Engineering-(2017),16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., “Soil Testing for Engineers”, Wiley Eastern Ltd., New Delhi.
3. Head K.H., “Manual of Soil Laboratory Testing” Vol. I, II, III, Princeton Press
4. BowlesJ.E.,“EngineeringPropertiesofSoilandTheirMeasurements”,-McGrawHillBookCo.NewYork.
5. Relevant BIS Codes of Practice: IS-2720 series

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

**DESIGN OF PRE-STRESSECONCRETE**

| | | | |
|---|---|---|---|
| Course Code | **18CV81** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to learn Design of Pre Stressed Concrete Elements.

**Module -1**

**Introduction and Analysis of Members:** Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations –Pre stressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.
Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete – pre stressed concrete - Force concept - Load balancing concept - Kern point -Pressure line.

**Module -2**

**Losses in Pre stress:** Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.
Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

**Module -3**

**Design of Sections for Flexure:** Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members.

**Module -4**

**Design for Shear:** Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

**Module -5**

Different anchorage system and design of end block by latest IS codes.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the requirement of PSC members for present scenario.
2. Analyse the stresses encountered in PSC element during transfer and at working.
3. Understand the effectiveness of the design of PSC after studying losses
4. Capable of analyzing the PSC element and finding its efficiency.
5. Design PSC beam for different requirements.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

**1.** Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
2. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
3. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

**Reference Books:**

1. Praveen Nagarajan, “Advanced Concrete Design”, Person Publishers
2. P. Dayaratnam, “Pre stressed Concrete Structures”, Scientific International Pvt. Ltd.
3. Lin T Y and Burns N H, ‘Design of Pre - stressed Concrete Structures’ , John Wiley and Sons, New York
4. Pundit G S and Gupta S P, “Pre - stressed Concrete”, C B S Publishers, New Delhi
5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

**BRIDGE ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **18CV821** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to understand the analysis and design of concrete Bridges.

**Note: All designs have to be done by Working Stress Method**

**Module -1**

Introduction to bridges, classification, selection of bridge site and preliminary and detailed survey work computation of discharge, linear waterway, economic span, afflux, scour depth.
Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

**Module -2**

Design of Slab Bridges: Straight and skew slab bridges.

**Module -3**

Design of T beam bridges(up to three girder only)
Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

**Module -4**

Other Bridges:
Design of Box culvert (Single vent only).
Design of Pipe culverts.

**Module -5**

Substructures - Design of Piers and abutments,
Introduction to Bridge bearings, Hinges and Expansion joints.(No design).

**Course outcomes:** After studying this course, students will be able to:
1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India


**Reference Books:**

1. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2.,Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. "Concrete Bridges", The Concrete Association of India

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VIII | | | |
|---|---|---|---|
| **PREFABRICATED STRUCTURES** | | | |
| Course Code | **18CV822** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to
1. Understand modular construction, industrialized construction
2. Design prefabricated elements.
3. Understand construction methods.

**Module -1**

**Introduction:** Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.

**Module -2**

**Prefabricated Components:** Behavior of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels–Columns–Shear walls.

**Module -3**

**Design Principles:** Disuniting of structures-Design of cross section based on efficiency of material used–Problems in design because of joint flexibility–Allowance for joint deformation.

**Module -4**

**Joint In Structural Members:** Joints for different structural connections–Dimensions and detailing–Design of expansion joints.

**Module -5**

**Design For Abnormal Loads:** Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

**Course Outcomes:** After studying this course, students will be able to:
1. Use modular construction, industrialized construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

**Reference Books:**

1. KonczT.,"Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH,1976.
2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

## ADVANCED FOUNDATION ENGINEERING

| | | | |
|---|---|---|---|
| Course Code | **18CV823** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course.
2. Develop profound understanding of shallow and deep foundation analyses.
3. Develop understanding of choice of foundation design parameters.
4. Learn about cause and effect of dynamic loads on foundation.

**Module -1**

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

**Module -2**

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure.

**Module -3**

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

**Module -4**

**Well Foundations:** Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.

Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

**Module -5**

Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

**Course outcomes:** After studying this course, students will be able to:

1. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
2. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles.
3. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
4. Understand basics of analysis and design principles of machine foundations.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Punmia B.C., "Soil Mechanics and Foundation Engineering,Laxmi Publications Co., India.
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

| Reference Books: |
| --- |
| 1. Bowles J.E., “Foundation Analysis and Design”, McGraw Hill Pub. Co. New York.<br>2. Swami Saran, “Analysis and Design of Substructures”, Oxford & IBH Pub. Co. Pvt. Ltd., India.<br>3. R.B. Peck, W.E. Hanson & T.H. Thornburn, “Foundation Engineering”, Wiley Eastern Ltd., India.<br>4. Braja, M. Das, “Principles of Geotechnical Engineering”, Cengage Learning, India.<br>5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes. |

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

**REHABILITATION AND RETROFITTING**

| | | | |
|---|---|---|---|
| Course Code | **18CV824** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to;
1. Investigate the cause of deterioration of concrete structures.
2. Strategies different repair and rehabilitation of structures.
3. Evaluate the performance of the materials for repair.

**Module -1**

**General**: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

**Module -2**

**Damage Assessment:** Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems.

**Module -3**

**Influence on Serviceability and Durability:** Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

**Module -4**

**Maintenance and Retrofitting Techniques:** Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.

**Module -5**

**Materials for Repair and Retrofitting:** Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

**Course outcomes:** After studying this course, students will be able to:
1. Identify the causes for structural (Concrete) deterioration.
2. Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
3. Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
4. Select suitable material and suggest an appropriate method for repair and rehabilitation.

**Question paper pattern:**
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. Sidney, M. Johnson, “Deterioration, Maintenance and Repair of Structures”
2. Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”- Longman Scientific and Technical.


**Reference Books:**

1. R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons
**2.** Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL).
**3.** CPWD Manual

**B. E. CIVIL ENGINEERING**
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**SEMESTER - VIII**

## PAVEMENT DESIGN

| | | | |
|---|---|---|---|
| Course Code | **18CV825** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas ) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

**Module -1**

**Introduction**: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement

Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

**Module -2**

**Design Factors:** Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.

Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.

**Module -3**

**Flexible Pavement Failures, Maintenance and Evaluation:** Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for
Airfield pavement and problems on above.

**Module -4**

**Stresses in Rigid Pavement** : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above.

**Design of Rigid Pavement**: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.

**Module -5**

**Rigid Pavement Failures, Maintenance and Evaluation:** Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.

**Course outcomes:** After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**


1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.


**Reference Books:**


1. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
2. SubhaRao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design", University Press.
4. Relevant recent IRC codes

**B. E. CIVIL ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER - VIII**

**PROJECT WORK PHASE-2**

| | | | |
|---|---|---|---|
| Course Code | **18CVP83** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | - | SEE Marks | 60 |
| Credits | 08 | Exam Hours | 03 |

**Course objectives:**

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

**Project Work Phase - II:** Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

**Course outcomes:** At the end of the course the student will be able to:

- Describe the project and be able to defend it.
- Develop critical thinking and problem solving skills.
- Learn to use modern tools and techniques.
- Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
- Develop skills to work in a team to achieve common goal.
- Develop skills of project management and finance.
- Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
- Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

**Evaluation Procedure:**

- **As per University guidelines**
- **Internal Marks:** The Internal marks (100 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.
- **Semester End Examination:** SEE marks for the project (100 marks) shall be based on Project report, Presentation and Demonstration of the actual/model/prototype of the project, as per the University norms by the examiners appointed VTU.

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VIII | | | |
|---|---|---|---|
| **TECHNICAL SEMINAR** | | | |
| Course Code | **18CVS84** | CIE Marks | 100 |
| Teaching Hours/Week(L:T:P) | **--** | SEE Marks | **--** |
| Credits | 01 | Exam Hours | 03 |

**Course Learning Objectives:**

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order.

- Conduct literature survey in the domain area to find appropriate topic.
- Prepare the synopsis report with own sentences in a standard format.
- Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
- Present the seminar topic orally and/or through power point slides.
- Communicate effectively to answer the queries and involve in debate/discussion.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

**Course Outcomes:** At the end of the course the student will be able to:

- Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study.
- Identify and discuss the current, real-time issues and challenges in engineering & technology.
- Develop written and oral communication skills.
- Explore concepts in larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.
- Develop the skills to enable life-long learning.

**Evaluation Procedure:**

- As per University guidelines.
- The Internal Assessment marks for the seminar shall be awarded based on the relevance of the seminar topic, quality of the report, presentation skills, participation in the question and answer, and attendance in the seminar classes/sessions.

| B. E. CIVIL ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER - VIII | | | |
|---|---|---|---|
| **INTERNSHIP /PROFESSIONAL PRACTICE** | | | |
| Course Code | **18CVI85** | CIE Marks | 40 |
| Teaching Hours/Week(L:T:P) | Industry Oriented | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to get the field exposure and experience

**Note: Internship /Professional Practice:**

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organization should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.
6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.

***Categories of courses for B.E. (2022 scheme)***

| SN | Course Area | Credit Distribution |
|---|---|---|
| **1.** | Humanities Social Sciences including Management (HS) | 09 |
| **2** | Basic Sciences (BS) | 20 |
| **3.** | Engineering Sciences (ES) | 26 |
| **4.** | Professional Core (PC) | 54 |
| **5.** | Professional Electives (PE) | 12 |
| **6.** | Ability Enhancement Course (AEC) | 8 |
| **7.** | Open Electives | 9 |
| **8.** | Project Work (Mini/Major) | 10 |
| **9.** | Internship (INT) | 10 |
| **10.** | Universal Human Values (UHV) | 2 |
| **11.** | Mandatory Non-Credit Course (MNC) | 0 |
| | Total | 160 |

**CREDIT DISTRIBUTION FOR B.E. PROGRAMME**

| SEM | HS | BS | ES | PC | PE | AEC | OE | PW | INT | UHV | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | 20 |
| 2 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | 20 |
| 3 | | 3 | 3 | 12 | | 1 | | | | 1 | 20 |
| 4 | | 3 | 3 | 12 | | 1 | | | | 1 | 20 |
| 5 | 5 | | | 9 | 3 | 1 | | 2 | | | 20 |
| 6 | | | | 9 | 3 | 3 | 3 | 2 | | | 20 |
| 7 | | | | 12 | 3 | | 3 | 6 | | | 24 |
| 8 | | | | | 3 | | 3 | | 10 | | 16 |
| TOTAL | 9 | 20 | 26 | 54 | 12 | 8 | 9 | 10 | 10 | 2 | 160 |

**B.E. in Civil Engineering Scheme of Teaching and Examinations 2022**
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year (2023-24)

**III SEMESTER**

| Sl. No | Course | Course Code | Course Title | Teaching Department (TD)and Question Paper Setting Board (PSB) | Teaching Hours/Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | SDA | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22XX31/ 22BB31 | Biology for Engineers | MATHS/XX/CHEM | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CV32 | Engineering Survey | CV | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CV33 | Engineering Geology | CV | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CV34 | Strength of Materials | CV | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CVL35 | Computer Aided Drawing Lab | CV | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CV36x | Engineering Science Course | CV | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22SC37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC/ SEC | 22CV38x | Departmental Specific Ability Enhancement Course | Any Department | If the course is A theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If a course is a laboratory | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | **Total** | **550** | **350** | **900** | **20** |

| | | | |
|---|---|---|---|
| **Engineering Science Course (ESC/ETC/PLC)** | | | |
| 22CV361 | Rural, Urban Planning and Architecture | 22CV363 | Sustainable Design Concept for Building Services |
| 22CV362 | Geospatial Techniques in Practice | 22CV364 | Building material construction. |
| **Departmental Specific Ability Enhancement Course–III** | | | |
| 22CV381 | Data analytics with Excel - IBM | 22CV383 | Problem Solving with PYTHON |
| 22CV382 | Smart Urban Infrastructure | 22CV384 | Personality Development for Civil Engineers |

**B.E. in Civil Engineering Scheme of Teaching and Examinations 2022**

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

**IVSEMESTER**

| Sl. No | Course and Course Code | | Course Title | Teaching Department (TD)and Question Paper Setting Board (PSB) | Teaching Hours/Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical /Drawing | Self-Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22XX41/ 22BB41 | Applied Mathematics for The Program | MATHS/XX/ CHEM | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CV42 | Fluid Mechanics and Hydraulics | CV | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CV43 | Concrete Technology | CV | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CV44 | Analysis of structures | CV | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CVL45 | Building Materials Testing Lab | CV | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CV46X | ESC/ETC/PLC | CV | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | AEC/ SEC | 22CV47X | Skill Enhancement Course- IV (Soft skills & basic Aptitude) | TD and PSB: Concerned department | If the course is Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If the course is a lab | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 8 | UHV | 22UH48 | Universal Human Values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | 22NS49 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE49 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Yoga | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | **Total** | **500** | **400** | **900** | **20** |

| **Ability Enhancement Course /Skill Enhancement Course -IV** | | | 5 |
|---|---|---|---|
| 22CV471 | Soft skills & basic Aptitude | 22CV473 | Electronic Waste Management - Issues and Challenges |
| 22CV472 | Total station Lab | 22CV474 | Technical Writing Skills |
| **Engineering Science Course (ESC/ETC/PLC)** | | | |
| 22CV461 | Concreting Techniques & Practices | 22CV463 | Disaster Management & Mitigation |
| 22CV462 | Construction Equipment, Plants and Machinery | 22CV464 | Alternative Building Materials |

**Semester: 3**

**Course Name: Engineering Survey**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV32** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Course objectives:**

1. Provide basic knowledge about principles of surveying for location, design and construction of engineering projects.
2. Develop skills for using surveying instruments including levelling instruments, plane table, theodolite, compass
3. Make students to familiar with co-operative efforts required in acquiring surveying data and applying fundamental concepts to eliminate error sand set out the works.
4. Provide information about new technologies that are used to abstracting the information of earth Surface.

## Module – 1

**Introduction to Surveying**: Importance of surveying in Civil Engineering, Concepts of plane and geodetic surveying Principles of surveying –Plans and maps – Surveying equipment's.
**Compass surveying:** Meridians, Bearings, Dip, Declination, Prismatic and surveyor's compasses, temporary adjustments, Calculation of bearings and included angles, Local attraction.

**8 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

Chalk and talk method, Power point presentation and videos, Field visits

## Module - 2

**Levelling**–Principlesandbasicdefinitions–TypesofLevels–Typesofadjustmentsandobjectives – Types of levelling – Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning –Booking of levels – Rise & fall and H. I methods (Numerical)
**Areas and volumes:** Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpsons one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes-trapezoidal and prismoidal formula.

**8 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

Chalk and talk method, Power point presentation and videos, Field visits

## Module – 3

**Theodolite Surveying:** Theodolite and types, fundamental axes and parts of theodolite, temporary adjustments of transit theodolite, Horizontal and Vertical angle measurements by repetition and reiteration.

**Trigonometric levelling**: Single and Double plane for finding elevation of objects, Computation of distances and elevations using Tachometric method (Numerical).

**8Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

Chalk and talk method, Power point presentation and videos, Field visits

## Module – 4

**Curve Surveying:** Curves – Necessity – Types, Simple curves, Elements, Designation of curves, setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankine's deflection angle method (numerical problems).

**Compound curves:** Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius).

**8 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

Chalk and talk method, Power point presentation and videos

## Module – 5

**Photogrammetry and aerial survey:** Introduction, definitions, basic principles, methods, importance of scale, height, applications.

**Remote sensing:** Introduction, Principle of Remote sensing, EMR, types, resolutions, types of satellites, type of sensors, LIDAR, visual and digital image processing and its applications.

**Advanced instrumentation in surveying:** classification, measuring principles, Electronic theodolite, EDM, Total Station, Drones.

**8 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

Chalk and talk method, Power point presentation and videos

| Sl.NO | Experiments 8 hrs to 10 hrs |
|---|---|
| 1. | Study of various instruments used for surveying, namely chain, tape, Compass, Dumpy level, Auto-level, Theodolite, Tacheometer, Total station and GPS. |
| 2. | To set regular geometric figures (Hexagon and Pentagon) using prismatic compass, given the bearing of one line. |
| 3. | Study of use of Dumpy level and to determine the different in elevation between two points by differential levelling using Dumpy level |
| 4. | To find the true difference in elevation between two points situated far apart by using Reciprocal levelling. |
| 5. | Trigonometrical levelling: Single plane method and Double plane method |
| 6. | Measurement of horizontal angle using theodolite by :i)Method of Repetition and ii) Reiteration method. |
| 7. | Setting simple circular curve-Instrumental method, |
| 8. | Demo: Total station, GPS |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

1. Execute survey using compass and plane table
2. Find the level of ground surface and Calculation of area and volumes
3. Operate theodolite for field execution
4. Estimate the capacity of reservoir.
5. Interpret satellite imageries

## Assessment Details

**1. Integrated professional Core Courses (IPCC):**

**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| **X** | **Total Marks for theory component A+B** | | | **30** |

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Surveying & levelling Vol. I, II & III | B.C. Punmia | Laxmi Publications; | Seventeenth edition, 2016 |
| 2. | Advanced Surveying: Total Station, GPS, GIS & Remote Sensing. | Gopi Satheesh, R. Sathi kumar, N. Madhu | Pearson | 2017 |
| **Reference Books** | | | | |
| **SN** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| 1. | Surveying Vol. I & II, | S.K. Duggal, | McGraw-Hill Education; | Fourth edition (2017) |

**Course Name: Engineering Geology**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV33** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

- Rocks and mineral samples
- Physical properties of minerals and rocks
- Toposheets and Geological maps

**Course objectives:**

This course (22CV33) will enable the students to

1. Understand the basics of geology that are relevant to take the important decisions in Civil Engineering.
2. Identify the physical characteristics of the rocks and Minerals for its suitable application.
3. Use of rocks as building materials and selection of ideal sites for important Civil Engineering structures.
4. Know about ground water exploration, natural hazards and their impact on environment.
5. Apply the modern tools and techniques in Civil Engineering Projects.

**Module – 1**

| |
|---|
| **Introduction, the scope of earth science in Engineering.**<br>Earth's internal structure and composition, internal dynamics and Plate tectonics, Earthquakes - types, causes, so-seismic lines, seismic zonation, seismic proof structures. Volcanic eruption - types, causes. Landslides-causes types, preventive measures; Tsunami – causes, consequences, mitigation. Cyclones - causes and management.<br>**8 Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, Power point presentation and videos, Field visits |

**Module - 2**

| |
|---|
| **Earth Materials in Construction**<br>Minerals - Definition, Classification, rock-forming and ore minerals. Physical properties, composition.<br>Rocks Types, structure/Texture, mineral composition occurrence, properties. Decorative (facing/polishing), railway ballast, rocks for masonry work, monumental/architecture, Dressing of stones, Requirement of good building stones.<br>**8 Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, Power point presentation and videos, Field visits |

## Module – 3

| |
|---|
| **Earth Surface process and Resources**<br>Weathering, type, causes, soil insitu, drifted soil, soil profile, soil mineralogy, structure, types of soil, Black cotton soil v/s Lateritic soil; effects of weathering on monumental rocks. Soil Horizon, Soil Classification by Grain Size.<br>**8Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, Power point presentation and videos, Field visits |

## Module – 4

| |
|---|
| **Surface and sub investigation for deep foundation**<br>Dip and strike, and outcrop problems(numerical problem geometrical/ simple trigonometry based), Borehole data(and problems), Faults, folds, unconformity, joints, types, recognition and their significance in Civil engineering projects like tunnel project, dam project, Reservoir site,.<br>**8 Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, Power point presentation and videos |

## Module – 5

| |
|---|
| **Modern Tools and geophysical methods**.<br>Hydrological cycle, Rocks as aquifers & its types,, water-bearing properties of igneous, sedimentary and metamorphic rocks , coefficient of permeability, factors affecting permeability, Groundwater exploration by geophysical method,, Artificial recharge of groundwater. Application of GIS and GPS in Civil Engineering.<br>**8 Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, Power point presentation and videos |

| Sl.NO | Experiments 8 hrs to 10 hrs |
|---|---|
| 1 | Identification of common minerals based on Physical Properties |
| 2 | Identification of rocks used in building construction based on Physical properties |
| 3 | Solving Geological maps for suitability for aqua duct |
| 4 | Geological maps with inclined beds, suitability for tunnels/ Dams |
| 5 | Geological maps with folds, in tunnels/ Dams |
| 6 | Geological maps with unconformity , in tunnel/dam project |
| 7 | Geological maps with faults in Dams/tunnels project |
| 8 | One Day Nearest Field Visit Investigation. |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

- Apply geological knowledge in different civil engineering practice.
- Acquire knowledge on durability and competence of foundation rocks, and will be able to usethe best building materials.
- Students will become competent enough for the safety, stability, economy and life of thestructures that they construct
- Able to solve various issues related to ground water exploration, build up dams, bridges,tunnels which are often confronted with ground water problems
- Students will become Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction.

## Assessment Details

**2. Integrated professional Core Courses (IPCC):**

**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| **X** | **Total Marks for theory component A+B** | | | **30** |

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Text book of Engineering and General Geology | Parbin Singh | S. K. Kataria& Sons | 8th Revised Edn,2008 |
| 2 | A Text book of Geology | P. K. Mukerjee | The World Press | 11th revision edition, 1990 |
| 3 | Engineering Geology | VasudevKanithi | Universities Press (India) Pvt. Ltd | 2018 |
| **Reference Books** | | | | |
| 1 | Theory of Structural Geology | N.W. Gokhale | CBS Publishers &Distributors | 2nd Edn. 2003 |
| 2 | Principles of Petrology | G.W.Tyrrel | BI Publications PvtLtd | Delhi1stEdn 1987 |
| 3 | Engineering Geology | S.K. Duggal, H.K.Pandey, N.Rawal | Mc Graw Hill Education publications | 2017 |

## E-Resources:

- https://www.youtube.com/watch?v=aTVDiRtRook&list=PLDF5162B475DD915F
- https://www.youtube.com/watch?v=EBiLLJAxBuU&index=2&list=PLDF5162B475DD915F
- https://www.youtube.com/watch?v=sTY-ao4RZck&list=PLDF5162B475DD915F&index=3  https://nptel.ac.in/courses
- https://youtu.be/fvoYHzAhvVM
- https://youtu.be/aTVDiRtRook

## Course Name: Strength of materials

| | | | |
|---|---|---|---|
| **Course Code:** | **22CV34** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Module – 1**

Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

**8 Hours (RBT Levels: L1, L2, L3)**

**Module - 2**

Bending moment and shear force diagrams in beams: Definition of shear force and bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, development of Shear Force Diagram(SFD) and Bending Moment Diagram (BMD) with salient values for cantilever, simply supported and overhanging beams for point loads, UDL(Uniformly Distributed Load), UVL(Uniformly Varying Load) and Couple.

**8 Hours (RBT Levels: L1, L2, L3)**

**Module – 3**

Bending stress in beams: Introduction – Bending stress in beam, Pure bending, Assumptions in simple bending theory, derivation of Simple bending equation (Bernoulli's equation), modulus of rupture, section modulus, Flexural rigidity, Problems Shear stress in beams: Derivation of Shear stress intensity equations, Derivation of Expressions of the shear stress intensity for rectangular, triangular and circular cross sections of the beams. Problems on calculation of the shear stress intensities at various critical levels of T, I and Hollow rectangular cross sections of the beam.

**8 Hours (RBT Levels: L1, L2, L3)**

**Module – 4**

Torsion: Twisting moment in shafts, simple torque theory, derivation of torsion equation, tensional rigidity, polar modulus, shear stress variation across solid circular and hollow circular sections.
Compound stresses: Introduction, Stress components on inclined planes, General two dimensional stress system, Principal planes and stresses, maximum shear stresses and their planes (shear planes). Compound stress using Mohr's circle method

**8 Hours (RBT Levels: L1, L2, L3)**

**Module – 5**

Elastic stability of columns: Introduction – Short and long columns, Euler's theory on columns, Effective length, slenderness ratio, radii of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different boundary conditions, Limitations of Euler's theory, Rankine's formula and related problems.

Deflection of determinate Beams: Introduction, Elastic curve –Derivation of differential equation of flexure, Sign convention, Slope and deflection using Macaulay's method for statically determinate beams subjected to various vertical loads, moment, couple and their combinations. Numerical problems.

**8 Hours (RBT Levels: L1, L2, L3)**

Course Outcomes:
1. Evaluate the behaviour when a solid material is subjected to various types of forces (namely Compressive, Tensile, Thermal, Shear, flexure, Torque, internal fluid pressure) and estimate stresses and corresponding strain developed.
2. Estimate the forces developed and draw schematic diagram for stresses, forces, moments for simple beams with different types of support and are subjected to various types of loads .
3. Evaluate the behaviour when a solid material is subjected to Torque and internal fluid pressure and estimate stresses and corresponding strain developed.
4. Distinguish the behaviour of short and long column and calculate load at failure & explain the behaviour of spring to estimate deflection and stiffness
5. Examine and Evaluate the mechanical properties of various materials under different loading conditions

**Assessment Details**

CIE :

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1. | Strength of Materials | S S Bhavikatti | Vikas Publishing house | Third Edition |
| 2. | Strength of Materials | Dr.R.K.Bansal | Laxmi Publications, New Delhi 2014. | Fifth Edition |
| 3. | Strength of Materials | Beer & Johnston | TATA McGraw Hill New Delhi 2006. | Third Edition |
| Reference Books | | | | |
| 1 | Elements of Strength of Materials | Timoshenko and Young | East West Press | 5th edition 2003 |
| 2 | Strength of Materials | R. Subramanyam | Oxford University Press | 3rd Edition -2016 |
| 3 | Strength of Materials | B.C Punmia Ashok Jain, Arun Jain | Laxmi Publications | 8th Edition-2018. |

**E-Resources:**

1.Strength of Materials web course by IIT Roorkee

https://nptel.ac.in/courses/112107146/

2.Strength of Materials video course by IIT Kharagpur

https://nptel.ac.in/courses/105105108/

3.Strength of Materials video course by IIT Roorkee

https://nptel.ac.in/courses/112107147/18 4.

4.All contents organized

http://www.nptelvideos.in/2012/11/strengthof-materials-prof.html

Name of the Laboratory: **COMPUTER AIDED BUILDING PLANNING AND DRAWING**

| | | | |
|---|---|---|---|
| **Course Code** | **22CVL35** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

## Course Objectives:

1. Achieve skill sets to prepare computer aided engineering drawings.
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings

## MODULE – 1
## Introduction to AutoCAD

| Sl. No | Experiments |
|---|---|
| 01 | **Drawing Tools:** Lines Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse. |
| 02 | **Modify tools:** Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, |
| 03 | **Using Text:** Single line text, Multi line text, Spelling, Edit text. |
| 04 | **Special Features:** View tools, Layers concept, Dimension tools, Hatching, Customizing Toolbars, Working with multiple drawings. |
| 05 | **Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS:962. |
| 06 | Basic concepts of Plan, Elevation & Cross-sectional Elevation. |
| 07 | Principles of planning, building byelaws, notations and symbols used in drawings, Types of buildings- Residential (load bearing and framed), public buildings, and design aspects for different public buildings. Recommendations of NBC. |

## MODULE – 2
## Drawings of different Building Elements

| Sl. No | Experiments |
|---|---|
| 01 | Cross section of Foundation. |
| 02 | Cross section of Masonry wall. (BBM) |
| 03 | Plan, Cross Section & Elevation of RCC column with Isolated footing. |
| 04 | Cross section of Lintel with Chejja. |
| 05 | Draw Plan, Cross-sectional Elevation of different types of staircase.<br>a. Dog legged staircase.<br>b. Open newel staircase. |

**Note:** Students should sketch to dimension the above in a sketch book before doing the computer drawing.

## MODULE – 3

| Sl. No | Experiments |
|---|---|
| 01 | **Residential Buildings**<br>Preparation of Plan, elevation, cross section and schedule of openings for load bearing and framed structures - ground floor, first floor and two storey buildings (framed only) using AUTOCAD for the following buildings.<br>a. Single story residential building.<br>b. Multistory Residential building. |
| 02 | **Public Buildings**<br>Preparation of Plan, elevation, cross section and schedule of openings for public buildings like<br>a. School Building<br>b. Hostel Building<br>c. Hospital Building |

| | |
|---|---|
| 03 | **Building Services**<br>Preparing a building plan showing building services like<br>a. Water supply & sanitation.<br>b. Electrical services for prepared plans of residences and public buildings using AUTOCAD |

**Note:**

- Studentsshouldsketchtodimensiontheaboveinasketchbookbeforedoingthe computer drawing.
- Single line diagrams to be given in the examination.

**Course outcomes:**

1. Use of different commands of AUTO CAD Software.
2. Create layout plan, sanction drawings, working drawing using concept of layers.
3. Select the tools in AUTO CAD software to draw the various building components.
4. Plan and design of residential or public building as per the given requirement.
5. Preparing the drawings and detailing of RCC structural elements and other civil related drawing.



## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | Total Marks | | 50 |

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

**Semester End Evaluation (SEE):**

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the BOE.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners. Students can pick one question (experiment) from the questions lot prepared by the internal / external examiners jointly. Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours.

**Suggested Learning Resources:**

1. Demonstration in the lab.
2. 3D Animated videos of reinforcement in structural elements.
3. Prototype models of Reinforcement bars.
4. One compulsory field visit.

**Reference Books:**

1. MGShah,CMKale,SYPatki,“BuildingdrawingwithanintegratedapproachtoBuilt Environment Drawing”, Tata McGraw Hill Publishing co. Ltd, New Delhi.
2. GurucharanSingh,“BuildingConstruction”,StandardPublishers,&distributors,New Delhi.
3. MalikRSandaMeoGS,“CivilEngineeringDrawing”,AsianPublishers/Computech Publication Pvt Ltd

**e-resources:**

1. https://www.youtube.com/watch?v=pvKVy-eMDYc&vl=en
2. https://www.autodesk.in/campaigns/autocad-tutorials
3. https://www.youtube.com/watch?v=s4NSVKW7Frg
4. https://www.engineeringcivil.com/presentation-on-reinforcing-detailing-of-r-c-c-members.html

https://www.slideshare.net/gssnie/design-and-detailing-of-rc-structures

Course Name: **RURAL, URBAN PLANNING AND ARCHITECTURE**

| | | | |
|---|---|---|---|
| Course Code | 22CV361 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Credits | 3 | Exam Hours | 3 |

**Course objectives:**

1. To make the student understand about the past and present architecture of different parts of the world.
2. Rural and urban planning and growth and circulation of patterns and effect of increase in urbanization.
3. The basic planning required for urban and rural centres with respect to physical and social aspects.
4. Student s to visit the different place of architecture monuments to understand the concept.
5. To understand different types of architecture and planning.

**Module – 1**

**Introduction:** Aim and importance of Architecture, Architecture as a fine art. Role of an architect and an engineer. Essential principles and qualities of architecture with examples Factors of architecture: Mass, Form, Colour, Solids, and Voids, Uniformity, Balance and Symmetry, Painting with examples.

**8 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module - 2**

**Architectural influence of the following:** Association, Tradition, Climate, Materials, Topography, Religion social customs and aspiration of time. Architectural characteristics of the following architecture with examples. 1. Egyptian, 2. Greek, 3. Roman, 4. Buddhist, 5. Hindu, 6. Jain, 7. Chalukyan, 8. Modern architecture Factors that have influence present day Modern Architecture, Aesthetic difference between the past and present Architecture. Students are advised for a technical tour related Architecture and town planning to gain additional knowledge in this subject.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 3**

Human settlements, Rural and urban pattern of growth, Factors that promote growth and development of Rural and urban areas Ancient Town Planning in India: Principles of town planning and circulation pattern with examples

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 4**

| |
|---|
| **Industrialization:** Impact on town planning, Urbanization causes, its effect on town and cities, remedial measures both in urban and rural planning Circulation pattern in cities: Urban roads and streets, their functional classification, traffic survey data and its use in town planning<br>**8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 5**

| |
|---|
| Contemporary objectives and methods of planning of town: Development plans for cities, objectives and stages involved in their preparation and implementation, space standards for planning.<br>**8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits |

**Course Outcomes:**

1. Understand importance of architecture in rural and urban planning
2. Understand Influence of architecture
3. Design infrastructure for rural and urban region
4. Plan and design rural and urban roads.

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "History of Architecture" | Fletcher | CBS | 20th and 1999 |
| 2 | "Urban pattern" | Galliaon | Van Nostrand Reinhold | 1986 |
| 3 | "Principle of town and country planning" | Lewis Keeble | Estates Gazette Ltd | 4th and 1969 |
| **Reference Books** | | | | |
| 1 | "Urbanization and Urban Systems in India" | Ramachandran R | Oxford University Press, New Delhi. | 1989 |
| 2 | "Town planning" | Rangwala | Charothar Publication | 32nd and 2023 |
| | | | | |

**E-Resources:** https://archive.nptel.ac.in/courses/124/107/124107158/
https://nptel.ac.in/courses/124107001

Course Name: **Geospatial Techniques in Practice**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV362** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

**Course objectives:**

1. Introduce the concept of various geospatial technologies used in the industry.
2. Help to acquire basic idea about the processing and mapping with modern surveying equipment.
3. Elaborate proven concepts, business practices and applications of geospatial technology.
4. Explain learners understand how geospatial concepts are leveraged in handling real world business challenges of engineering and construction industry.

**Module – 1**

| |
|---|
| **Need of Geospatial technology in Industry**: Geospatial in Day to Day Life, Spatial thinking, Evolution of location technology and importance of geography and maps. Need for spatial information, Terminologies, logic, language and formats of spatial technology. Location perspective of construction industry, Overview of Geospatial technology in tenders, Design and execution and Construction lifecycle management. Fundamentals and components of Geospatial Engineering, Surveying and Conventional survey equipment Vs Modern surveying equipment Components. Digital Land Surveying Needs. **8 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module - 2**

| |
|---|
| **Total Station and Global Navigation Satellite System (GNSS)**: Basics of Surveying, Introduction to Survey and Mapping, Geospatial Surveying Equipment, Demo of Total Station Equipment, Setting out and mapping, Advanced geospatial solutions, GNSS Overview of components, working and signal structure of Global navigation System. **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 3**

| |
|---|
| **Geospatial Engineering and technology:** Remote Sensing Technologies, Types of remote sensing, Sensors and its types, Application of sensors & platforms, Image Acquisition, Applications of Remote Sensing. 3D scanning, Principles and the science behind photogrammetry, LiDAR, RADAR and SONAR. Introduction to Platforms and working. **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 4**

| |
|---|
| **Geographical Information System:** Basics of GIS, Vector & Raster data models, Types and components of a Map. Hardware for GIS, DEM and TIN Data products, Attribute Data Types. Basic GIS data conversions, conversions from non-spatial formats to spatial formats. Demo of Conversion of Excel to GIS, Demo of Conversion of CAD TO GIS, Demo of Downloading and Geo-referencing Topo sheets and Raster files. **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 5**

| |
|---|
| **Applications and Future trends of Geospatial Technologies:** Application of GIS - Spatial Analysis, Catchment Area delineation, Overlay Analysis, Cluster Analysis, Hotspot Analysis and View shed Analysis. Future Trends of Geospatial Technologies. Case Study 1 -Benefit Realization - Case Study 2 Advancements in Modern Survey & Mapping Technologies, Advancements in Spatial Analytics – Geo Intelligence, Future Trends, Geospatial Technology - Way Forward . **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits |

### Course Outcomes:

At the end of the course, the student will be able to,

1. Comprehend different geospatial techniques in the Construction Industry.

2. Understand the application of geospatial equipment like Total Station, GNSS, LIDAR, UAV (Drones), etc.,

3. Evaluate the various spatial analysis operations by using GIS Environment.

4. Create a map layout with all essential cartographic elements in GIS Environment.

5. Illustrate the various geospatial emerging trends of GIS in Industry.

### Assessment Details

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Surveying and Levelling, Parts 1 & 2 | T. P. Kanetkar and S. V. Kulkarni | Pune Vidyarthi Griha Prakashan, Pune | 2010 |
| 2 | Advanced Surveying, Total Station GPS and Remote Sensing | Satheesh Gopi, R. Sathikumar, N. Madhu | Pearson education | 2017 |
| **Reference Books** | | | | |
| 1 | Surveying, Theory and Practice, | James M. Anderson and Edward M. Mikhail | McGraw Hill | 2001 |
| 2 | Fundamentals of Remote Sensing, | George Joseph and C. Jeganathan | Universities Press (India) Private limited | 2018 |

**E-Resources:** E-learning content on L&T EduTech Platform.

Course Name: **SUSTAINABLE DESIGN CONCEPT FOR BUILDING SERVICES**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV363** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

**Course objectives:**

1. To facilitate learners to understand sustainable building designs and its parameters such as energy and water efficiency, Comfort in buildings, and waste management.
2. To expose the learners to shading systems, thermal and visual comfort.
3. To impart fundamental knowledge on Life cycle assessment and Green ratings and certifications.

**Module – 1**

**Introduction to Sustainability and Climatology:** Overview of Sustainability – Global energy scenario, carbon footprint and climate action, Net zero in carbon offsetting, Water neutral, Sustainable construction and resource management. Green buildings - Selection of site – preservation and planning, Influence of climate on buildings, Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems.

**8 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module - 2**

**Comfort in Buildings:** Thermal comfort – Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies Acoustics – Building acoustics, measures, defects and prevention of sound transmission Indoor Air Quality – Effects, design consideration and integrated approach for IAQ management Visual comfort – Enhancement strategies for Daylighting and Artificial.

**8 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 3**

**Energy, water efficiency and waste management in buildings:** Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system. Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities

**8 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 4**

| |
|---|
| **Life Cycle Assessment of Buildings and Green project management:** Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types – Modelling and Analysis Greenhouse gas emission. Different phases of Green building project management. **8 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 5**

| |
|---|
| **Sustainable rating systems:** Green building rating systems- LEED, BREEAM and others, Indian Green building rating systems – IGBC & GRIHA. IGBC criteria for certification -site selection credits, pre-design credits, detailed design credits, pre-construction credits, construction credits, post construction credits. **8 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits |

**Course Outcomes:**

1. Comprehend sustainable design, climatology, shading system and analyze heat transfer mechanism in buildings.
2. Assess the design considerations and parameters for thermal comfort, visual comfort, indoor air quality and acoustics.
3. Develop solutions for energy efficiency, water efficiency and waste management in buildings.
4. Adopt green project management methodology and evaluate building life cycle assessment.
5. Implement green practices during construction and operation phase of the buildings for achieving green rating.

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE-** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Green Building Fundamentals" | HarharaIyer G | Notion Press | 2022 |
| 2 | Green Building: Principles & Practices | Dr. Adv. HarshulSavla | Notion Press | 2021 |
| | | | | |
| **Reference Books** | | | | |
| 1 | "National Building Code – 2016 Volume 1&2" | | Bureau of Indian Standards | 2016 |
| 2 | "Energy Conservation Building Code – 2017" | | Bureau of Energy Efficiency | 2017 |
| | | | | |

**E-Resources:** E-learning content on L&T EduTech Platform.

Course Name: **BUILDING MATERIALS AND CONSTRUCTION**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV364** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

### Pre-requisites:

- Building materials (Aggregates, Cement etc).
- Material science.
- General pictorial view of the construction activities been carried out in the vicinity like roads, bridges, buildings etc.

### Course objectives:

1. Choose the good building materials to be used for the construction work, their manufacturing process, requirements, types and different tests.
2. Examine soil condition, properties to select suitable foundation for different structures and also knowing types of masonry.
3. Classify different materials and construction methods of building components like lintels, arches, floors and roof.
4. Design stairs and gaining knowledge about doors, windows, formwork, scaffolding, shoring, under pinning to take suitable engineering measures.
5. Relate about building finishes like plastering, pointing, painting, damp proofing.

### Module – 1

| |
|---|
| **Building Materials:**<br>**Stone** as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. **Bricks**; Classification-first class, second class, third class and fourth class bricks. Manufacturing of clay bricks, Requirements of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage. **Timber-** Characteristics & uses. **Fine aggregate:** Natural and manufactured: Sieve analysis, specify gravity, bulking, moisture content. **Coarse aggregate:** Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.<br>**8 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module - 2

| |
|---|
| **Foundation:** Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation, types of foundation, introduction to spread, combined, strap, mat and pile foundation.<br><br>**Masonry:** Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone |

masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry. Types of walls; load bearing, partition walls, cavity walls.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 3

**Lintels and Arches:** Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.
**Floors and roofs:** Floors; Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.
**Roof:** Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 4

**Doors, Windows and Ventilators:** Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.
**Stairs:** Definitions, technical terms and types of stairs: Wood, RCC, Metal. Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.
**Formwork:** Introduction to form work, scaffolding, shoring, under pinning.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 5

**Plastering and Pointing:** Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering. Water proofing with various thicknesses.

**Damp proofing-** causes, effects and methods.

**Paints-** Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

### Course Outcomes:

**1**. Choose suitable building materials and tests to be conducted.
**2**. Examine the soil properties to select suitable foundation and also know about different masonry works.
**3**. Classify the different Construction methods for building elements.
**4**. Design the stairs and also know about the doors, windows and formwork requirements.
**5**. Relate the various materials required for building finishes.

### Assessment Details

CIE:

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

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### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | “Building Materials and construction” | Sushil Kumar | Standard Publishers | 20th edition, reprint, 2015 |
| 2 | “Building Construction” | Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain | Laxmi Publications (P) ltd., New Delhi. | |
| 3 | “Engineering Materials” | Rangawala S. C. | Charter Publishing House, Anand, India | |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | "Building Materials" | S. K. Duggal | New Age International (P) Limited | (Fourth Edition) 2016 National Building Code(NBC) of India |
| 2 | "Building Materials" | P C Vergese | PHI Learning Pvt.Ltd | |
| 3 | Building Materials and Components | | CBRI | 1990,India |
| 4 | "Alternative Building Materials Technology" | Jagadish. K.S, | New Age International | 2007 |
| 5 | "Concrete Technology" | M. S. Shetty | S. Chand & Co. New Delhi. | |

**E-Resources:**

https://archive.nptel.ac.in/courses/105/102/105102088/

https://theconstructor.org/building/types-of-building-materials-construction/699/

https://edurev.in/courses/22969_Construction-Materials-Management

**Course Name: DATA ANALYTICS WITH EXCEL-IBM**

| | | | |
|---|---|---|---|
| Course Code | 22CV381 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 03 |

**Course Learning Objectives:** This course will enable students to

1. Understand the use of Spreadsheet for data collection and analysis.
2. Evaluate the equations using Excel functions.
3. Learn the data quality and consistency of data

**LIST OF EXPERIMENTS**

| Sl. No | Experiments |
|---|---|
| 1 | Introduction to Data Analysis Using Spreadsheets: Fundamentals of spreadsheet applications, Excel interface, and learn how to navigate around a worksheet and workbook. |
| 2 | Using Excel Spreadsheets: Perform basic spreadsheet tasks, such as viewing, entering and editing data, and moving, copying and filling data. Learn about the fundamentals of formulas, and learn about the most common functions used by a data analyst. Finally, you will learn how to reference data in formulas. |
| 3 | Cleaning & Wrangling Data Using Spreadsheets: Importance of data quality, how to import file data in to Excel, fundamentals of data privacy, remove duplicate and inaccurate data, and how to remove empty rows in your data. |
| 4 | How to deal with inconsistencies in your data and how to use the Flash Fill and Text to Columns features to help you manipulate and standardize your data. |
| 5 | Analyzing Data Using Spreadsheets: Fundamentals of analyzing data using a spreadsheet, and learn how to filter and sort data. Learn how to use some of the most useful functions for a data analyst. |
| 6 | How to use the VLOOKUP and HLOOKUP reference functions. In addition, learn how to create pivot tables in Excel, and use several pivot tables features. |
| 7 | Final Project: In this final module, you will be introduced to a hands-on lab where you will complete a graded assignment for cleaning and preparing data, and then analyzing data using an Excel spreadsheet. |
| 8 | Submission of report for final assessment. |

**Course Outcomes:**
After a successful completion of the course, the student will be able to:
1. Prepare the data sets and perform the analysis.
2. Analyze and perform repetitive calculations using several functions.
3. Design and apply solutions to verify the data sets.

**Suggested Learning Resources:**

- https://www.coursera.org/learn/excel-basics-data-analysis-ibm
- Any online platform with the above course content like YouTube videos and NPTEL courses.

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

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Course Name: **SMART URBAN INFRASTRUCTURE**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV382** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **1:0:0** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **3** |

**Course objectives:**

1. Knowing about Urban Infrastructure Systems & their Management
2. Knowing about Smart Cities Key Concepts
3. Understand the Transport and Energy Smart Urban Infrastructure and Services
4. Developing Feasibility Studies for Smart City Services
5. Understand the Global Context of Smart Cities

**Module – 1**

| |
|---|
| Introduction to Smart Urban Infrastructures and Smart Cities: Introduction to smart city, Basic concept of developing smart city, Global standards to create smart city. Different conceptual approaches to Smart Cities and discussing the pros and cons of each approach. Smart urban Infrastructure: List of infrastructure facilities, advantages and disadvantages. **8 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module - 2**

| |
|---|
| Smart Urban Energy Systems: Introduction to Smart Energy Systems, Government policy and technology. Energy sector to explore some of the most important managerial considerations in the transition phase and operation of Smart Urban Energy Systems. **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 3**

| |
|---|
| Smart Transportation Technologies: Introduction to smart transportation system, Mode of transport systems for smart city, data collection to arrive at best transport facility. Significant opportunities and threads for legacy urban transportation systems. Managerial considerations to facilitate the transition phase, and operation of Smart Urban Transportation Systems **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 4**

| |
|---|
| Towards Smart Cities: Important factors in the transition phase of legacy cities to Smart cities and their managerial implications. **8Hours** |
| **(RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 5**

| |
|---|
| Towards Smart Cities: Management of Smart Cities calls for different approaches from conventional urban management approaches. The role of city government in the network of actors who play an important role in management of smart cities. **8Hours** |
| **(RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits |

**Course Outcomes:**

1. Understand the concept of smart city
2. Play the role of a civil engineer in providing smart infrastructure
3. Design efficient energy system for smart city
4. Analyse and design efficient transport system

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Infrastructure for Smart Cities" | Dr. R P Rathaliya | Shree Hari Publications | 2021 |
| 2 | "Building Smart Cities" | Carol L. Stimmel | Auerbach Publications | 1st and 2022 |
| 3 | "Smart Cities for Sustainable Development" | Ram Kumar Mishra, Ch Lakshmi Kumari, Sandeep Chachra, P.S. Janaki Krishna, | Springer | 2022 |
| **Reference Books** | | | | |
| 1 | "Smart City Infrastructure" | Vishal Kumar, Vishal Jain, Bharti Sharma, Jyotir Moy Chatterjee, Rakesh Shrestha | Wiley-Scrivener | 2022 |
| 2 | "Solving Urban Infrastructure Problems Using Smart City Technologies" | John R. Vacca | Elsevier | 1st and 2020 |

**E-Resources:** [https://www.coursera.org/learn/smart-cities](https://www.coursera.org/learn/smart-cities)

Course Name: **PROBLEM SOLVING WITH PYTHON**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV383** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

**Course objectives:**

1. To understand why Python is a useful scripting language for developers.
2. To read and write simple Python programs
3. To learn how to identify Python object types.
4. To learn how to write functions and pass arguments in Python

**Module – 1**

**Introduction to Python:** Installing Python and Python packages, Managing virtual environments with venv module Introduction to NumPy arrays: Array creation, indexing, data types, broadcasting, copies and views, universal functions, I/O with NumPy

**8 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module - 2**

Introduction to NumPy and SciPy:NumPy subpackages– linalg, fft, random, polynomials, SciPy subpackages– linalg, fftpack, integrate, interpolate, optimize Introduction to Matplotlib: Plotting 2D graphs with Matplotlib, annotations, legend, saving plots to file, bar and pie charts, line plots.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 3**

Linear algebra using NumPy and SciPy: Solving linear simultaneous equations using NumPy and SciPy using numpy.linalg and scipy.linalg – solve, inverse, determinant, least square solution, Linear algebra using NumPy and SciPy (continued): Decomposition using lu and cholesky. Solving eigenvalue problems using NumPy and SciPy: Using numpy.linalg and scipy.linalg – eig, eigvals.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 4**

Solving initial value problems for ODE systems using scipy. integrate subpackage – solve_ivp, RK45, LSODA. Numerical integration of functions using SciPy: Using scipy.integrate subpackage– Definite integral using Gaussian quadrature – quad and quadrature Numerical integration of fixed samples using scipy. Integrate subpackage– Trapezoidal rule trapezoid, Simpson's 1/3 rule using Simpson, Romberg integration romb.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 5

| |
|---|
| Determining roots of equations using SciPyusing scipy.optimizesubpackage– Bisection method bisect, Brent's method brentq, Newton-Raphson method newton. Symbolic computing using SymPy and solving civil engineering problems using SymPy: Introduction, defining symbols, derivatives, integrals, limits, expression evaluation, expression simplification, solving equations, solving differential equations. **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits |

**Course Outcomes:**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Represent compound data using Python lists, tuples, Strings, dictionaries.
4. Read and write data from/to files in Python Programs

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
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| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
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**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Core Python Programming" | R. Nageswara Rao | Dreamtech Press | Second edition (1 January 2018) |
| 2 | "Python Programming" | Vamsi Kurama | Pearson | (10 July 2018) |
| 3 | "Python Programming" | Reema theraja, | OXFORD publication | 1st Edition, 2023 |

**E-Resources:**

- NumPy documentation at https://numpy.org/doc/
- SciPy documentation at https://docs.scipy.org/doc/scipy/
- Matplotlib documentation at https://matplotlib.org/stable/users/index
- SymPy documentation at https://docs.sympy.org/latest/index.html

Course Name: **PERSONALITY DEVELOPMENT FOR CIVIL ENGINEERS**

| | | | |
|---|---|---|---|
| Course Code | 22CV384 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 1 | Exam Hours | 3 |

**Course objectives:**

1. To offer placement focused guidance across interview best practices, formal communication, and business etiquette
2. To give learners a comprehensive understanding of job skills and knowledge that are essential for adapting to changes in workplace

**Module – 1**

**LSRW and Personality Development:** Importance of LSRW Skills: Art of listening- Listening comprehension – Art of Speaking – Art of Reading – Reading comprehension – Art of Writing – email writing Personality Development: Emotional Intelligence – Self Awareness – Self Management – Personal SWOT – Manners & Etiquette – Positive Attitude – Confidence building Interpersonal Skills: Active Listening – Motivation – Flexibility – Patience – Dependability – Adaptability – Interpersonal & Intrapersonal skills – Body Language

**8 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, YouTube videos.

**Module - 2**

**NVC, Presentation and Teamwork:** Non – Verbal Communication: Body language – Gestures – Postures – Eye contact – Hand Shake – First impression – Proxemics – Facial Expressions Presentation Skills: 4P's of Presentation – Communicating with Credibility – Audience analysis and Building Rapport – Usage of Figures, diagrams & Charts – Presenting with Confidence – Body Language in Presentation Teamwork: What is a Team - Stages of a Team – Benefits of Team work & Collaboration – Group vs Team – Types of Teams – Roles of the Team

**8 Hours (RBT Levels: 1,2,3,4)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, YouTube videos.

**Module – 3**

**Etiquette and Management:** Critical Thinking & Problem Solving: Core Skills – Uses & Importance of Critical Thinking – Principles of Critical Thinking – Facts about Problem Solving – Skills to use in Problem Solving - Problem Solving Process – Barriers to Problem Solving Time Management: Managing your time – Time wasters – Analyzing your Strengths and weakness – Goal Setting – Why Goal Setting is important - SMART Goals – Types of Goals Business Etiquette: Types of Etiquette – Importance of Etiquette – Meeting Etiquette –Office Etiquette – Phone and email Etiquette – Work Place Etiquette

**8 Hours (RBT Levels: 1,2,3,4,5)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos.

### Module – 4

**Leadership:** Leadership Skills: What makes an effective Leader – Relationship Building –Leader vs Boss – Decision Making Skills – Innovation & Motivation – Dependability Business Writing – How to improve your Business writing skills – Importance of Business writing – how to write effectively – 5C's of Business writing – 4 types of Business writing Conflict Management: Strategies of Conflict Management – Best practices for Conflict Resolution – Stress Management – Learn to say No – Importance of Conflict Management at Work Place

**8 Hours (RBT Levels: 1,2,3,4,5)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos.

### Module – 5

**V GD, Creativity and Psychometry:** Group Discussion: Types of GD – Attitude & being Proactive – Time management & how to stick to it – Importance of Listening - Do's & Don'ts Creativity & Innovation: What is Creativity – What is Innovation – Difference between Creativity & Innovation – Categories and misconception of Creativity Psychometric Analysis: What is Psychometric Analysis – Cognitive Skills – Importance of Personality Tests – Personality Profiling

**8 Hours (RBT Levels: 1,2,3,4)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos.

### Course Outcomes:

1. Use English as a medium of communication in interviews and in any professional working environment proficiently
2. Develop necessary skills to Answer common interview questions, express confidence in body language and present with clarity

### Assessment Details

CIE:

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
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**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Personality Development And Soft Skills | Barun K Mitra | Oxford University Press | $2^{nd}$ Edition, 2016 |
| 2 | Power of Positive thinking | Norman Vincent Peale | RHUK | 2016 |
| **Reference Books** | | | | |
| 1 | Magic of thinking Big | David J Schwartz | Vermilion | 2016 |
| | | | | |

**E-Resources:** NPTEL Videos

**Semester: IV**

Course Name: **FLUID MECHANICS AND HYDRAULICS (22CV42)**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV42** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Module – 1**

***Fluids and their properties***: Introduction, Concept of fluid, Definition of Mass Density, Specific weight, Specific Gravity, Viscosity, Surface Tension, Capillarity, Cohesion, Adhesion, Newton's law of viscosity, Classification of fluids. (No problems)
***Fluid Pressure and its Measurements:*** Introduction, Types of Pressures, Pressure at a point – Pascal Law –Proof, Hydrostatic law-statement and proof, Measurement of pressure using simple and Differential manometers. Problems on Manometers only
***Hydrostatic forces on surfaces:*** Introduction, Total pressure and center of pressure on vertical and Inclined plane surfaces. (No problems)

8 Hours

**Module - 2**

***Kinematics:*** Introduction, Types of fluid flow, Continuity equation in 3D Cartesian coordinates, Flow nets. (No problems)
***Dynamics:*** Introduction, Euler's equation of motion, Bernoulli's equation (No problems)
***Applications***: Venturi meter, Orifice meter, Pitot Tube, problems only on application

8 Hours

**Module – 3**

***Orifices and Mouth pieces:*** Introduction, Classification, Hydraulic Coefficients (No problems)
***Notches:*** Introduction, Discharge over Rectangular, Triangular and Cipoletti Notches, problems
***Flow through pipes:*** Introduction, Major and Minor losses, Darcy-Weisbach equation for head loss due to friction, Pipes in series, pipes in parallel, problems on frictional losses in pipes - concepts of water hammer and Surge Tank

8 Hours

**Module – 4**

***Open Channel Hydraulics:*** Introduction, Classification of flow through channels (Uniform and Non-Uniform flows) (No problems)
***Most economical channel sections***: Rectangular, Triangular, Trapezoidal, problems
***Non-Uniform flow:*** Equation for Hydraulic jump, Gradually varied flow equation, Specific energy, Specific energy curve Problems

8 Hours

**Module – 5**

***Impact of jet on curved vanes:*** Introduction, Momentum equation, Impact of jet on Stationary and moving curved vanes-problems.
***Turbines:*** Introduction, Pelton wheel and its components, Velocity triangle (No problems)
***Reaction Turbines***: Francis turbine and its components, Working Proportions (No problems)
***Centrifugal Pumps:*** Components, work done and efficiency, Multi stage pumps (No Problems)
8 Hours

## PRACTICAL COMPONENT OF IPCC

| Sl. NO | Experiments |
|---|---|
| 1 | Verification of Bernoulli's equation |
| 2 | Determination of Cd for Venturimeter or Orifice meter |
| 3 | Determination of Hydraulic coefficients of small vertical orifice |
| 4 | Calibration of Triangular notch or Rectangular notch |
| 5 | Determination of Major or minor losses in pipes |
| 6 | Determination of Cd for ogee or broad crested weir |
| 7 | Determination of force exerted by a jet on flat vane |
| 8 | Determination of efficiency of centrifugal pump |
| 9 | Determination of efficiency of Kaplan or Francis turbine |
| 10 | Determination of efficiency of Pelton wheel turbine |



**Course Outcomes:**

At the end of the course the student will be able to:

1. Understand fundamental properties of fluids and solve problems on Hydrostatics.
2. Apply Principles of Mathematics to represent Kinematics and Bernoulli's principles.
3. Compute discharge through pipes, notches and weirs'
4. Design of open channels of various cross sections.
5. Design of turbines for the given data and understand their operation characteristics.

# Assessment Details

**1. Integrated professional Core Courses (IPCC):**

**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| **X** | **Total Marks for theory component A+B** | | | **30** |

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Hydraulics and Fluid Mechanics, | P.N.Modi and S.M.Seth- | standard Book House, New Delhi | |
| 2 | Fluid Mechanics and Hydraulic Machines | K Subramanya | Tata McGrawhill, New Delhi | |
| 3 | A text book of Fluid Mechanics and Hydraulic Machines- | R.K. Bansal | Laxmi Publications, New Delhi | |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Fluid Mechanics | Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford | Tata McGraw Hill publishing Co Ltd,New Delhi | |
| 2 | Fluid Mechanics | J.F.Douglas,J .M .Gasoreik, John Warfield ,Lynne Jack | Pearson | Fifth edition. |
| 3 | Fluid Mechanics and Hydraulic Machines, Problems and Solutions, | K.Subramanya | Tata McGrawhill, New Delhi | |

**E-Resources:**

1. https://archive.nptel.ac.in/courses/105/103/105103192/
2. https://archive.nptel.ac.in/courses/105/103/105103095/
3. https://onlinecourses.nptel.ac.in/noc20_ce59/preview
4. https://www.youtube.com/watch?v=F_7OhKUYV5c

**Semester: IV**

Course Name: **CONCRETE TECHNOLOGY**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV43** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **4** | **Exam Hours** | **3** |

## Pre-requisites:

- Building materials (Aggregates, Cement etc.).
- Material science.
- General pictorial view of the construction activities been carried out in the vicinity like roads, bridges, buildings etc.

## Course objectives:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.



### Module – 1

**CEMENT AND AGGREGATES:**
Cement, Chemical composition, Physical and chemical properties, Other Cementitious materials and composition -GGBS, Fly ash rice Husk ash, Silica fume, Hydration of cement, Factors influencing and affecting Hydration of cement, Types of cement. Fine aggregate - grading, analysis, Specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. Codal Provisions.

**10 Hours (RBT Levels: 1,2)**

**Teaching-Learning Process:**
Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits.

### Module - 2

**FRESH PROPERTIES OF CONCRETE:**
Workability - Process of manufactures of concrete: Batching, Mixing, Assessment of Workability of Concrete, Factors affecting workability, Measurement of workability – slump test, flow test, Compaction factor test and Vee-Bee Consistometer tests, Segregation and bleeding, Transporting, Placing, Compaction, Curing, need and Types of curing, accelerated curing.

**10 Hours (RBT Levels: 1,2)**

**Teaching-Learning Process:**
Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 3

**ADMIXTURES:**

Classification, effect on fresh and hardened concrete, retention time, Dosage ant their effects, Influence on properties of paste, mortar, and concrete Types of concrete (in brief).

**MIX DESIGN PROCEDURE:**

Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design as per IS 10262-2019, Numerical examples of Mix Design. Highlights of Other methods of Mix Design as per other codes.

**10 Hours (RBT Levels: 1,2,3,4)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos.

## Module – 4

**HARDENED CONCRETE**:

Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, assessment of compressive strength, flexural strength, tensile strength, bond strength and modulus of elasticity, aggregate - cement bond strength, factors influencing strength and codal provisions, Relation between modulus of elasticity and strength, factors affecting modulus of elasticity, Poisson Ratio.

**10Hours (RBT Levels: 1,2)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 5

Durability - definition, significance, short term and long-term durability. Shrinkage - plastic shrinkage and drying shrinkage, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, Factors affecting shrinkage, Effect of creep. Measurement of creep, factors influencing creep. Permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Construction joints and Expansion joints, Thermal effect of concrete. Codal Provisions.

**10 Hours (RBT Levels: 1,2)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits

## PRACTICAL COMPONENT OF IPCC

| Sl.NO | Experiments |
|---|---|
| 1 | Testing of cement: Consistency, fineness, setting time, Specific Gravity, Soundness and strength. |
| 2 | Testing of fine aggregate: Specific Gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content. |
| 3 | Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index, elongation index, water absorption & moisture content, soundness of aggregate. |
| 4 | Concrete Mix design by ACI 211.1-91 method, IS code method as per 10262- 2019 & 456- 2000, DOE method |
| 5 | Tests on Concrete- Workability tests – Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test, strength tests- compressive strength, flexural strength, split tensile strength |
| 6 | Effects of Admixture - Accelerator, Retarder, Super Plasticizer |
| 7 | Non-destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test |

## Course Outcomes:

At the end of the course the student will be able to:

**1**. Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications (L2)
**2**. Design the concrete mix for the given materials as per IS:10262-2019 provisions (L4)
**3**. Understand the manufacturing process and asses the quality of green (L2)
**4**. Describe the properties of fresh and hardened concrete – Strength and Durability aspects (L3)
**5**. Examine and Evaluate properties of Cement and Concrete

## Assessment Details

**2. Integrated professional Core Courses (IPCC):**
**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| **X** | **Total Marks for theory component A+B** | | | **30** |

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Concrete Technology" | M. S. Shetty | S. Chand & Co. New Delhi. | 2002 |
| 2 | "Concrete Technology" | A.R.Santakumar | Oxford University Press | 2007 |
| 3 | "Advanced Concrete Technology" | Zongjin Li, Wiley | -- | 1 edition |
| 4 | "Concrete Mix Design" | N.KrishnaRaju | Sehgal - publishers | --- |
| **Reference Books** | | | | |
| 1 | Concrete: Microstructure, Properties, and Materials | P. Kumar Mehta , Paulo J. M. Monteiro, McGraw | Hill Education | ---- |
| 2 | Properties of Concrete | Neville, A.M | ELBS, London | --- |
| 3 | Concrete Manual | Gambhir Dhanpat Rai &Sons | New Delhi | --- |
| 4 | IS:10262-2016, "Recommended guidelines for concrete mix design | -- | Bureau of Indian Standards, New Delhi | --- |
| 5 | Concrete Technology (Trade, Technology & Industry) | George White, | Delmar Publications | --- |

**E-Resources:**

Cement https://nptel.ac.in/courses/105102012/1
Aggregates https://nptel.ac.in/courses/105102012/6
Mineral admixtures https://nptel.ac.in/courses/105102012/11

Chemical admixtures https://nptel.ac.in/courses/105102012/9
https://nptel.ac.in/courses/105102012/10
Concrete mix design https://nptel.ac.in/courses/105102012/14
Concrete production & fresh concrete https://nptel.ac.in/courses/105102012/19
Engineering properties of concrete https://nptel.ac.in/courses/105102012/23
Dimensional stability & durability https://nptel.ac.in/courses/105102012/27
Durability of concrete https://nptel.ac.in/courses/105102012/31
Special concretes https://nptel.ac.in/courses/105102012/36

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
● Seminars/Quiz (To assist in GATE Preparations
● Demonstrations in Lab
● Self Study on simple topics
● Simple problems solving using Excel
● Virtual Lab Experiments

**Semester: IV**
**Course Name: Analysis of structures**

| | | | |
|---|---|---|---|
| **Course Code:** | **22CV44** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

Pre-requisites: Students should have knowledge about engineering mechanics such as resolving the force, composition of force, resultant of force, moment of force, moment of couple centroid and moment of inertia of plane areas.

**Module – 1**

Introduction and Analysis of Plane Trusses Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and nonlinear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

**L1,L2,L3 08Hours**

**Module - 2**

DEFLECTION OF BEAMS: Moment area method: Derivation, Mohr's theorems, sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts. Strain Energy: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion (No numerical). Castigliano's theorems, application of Castigliano's theorems to calculate deflection of beams, trusses and frames (No numerical on unit load method).

**L1,L2,L3 08Hours**

**Module – 3**

Arches and Cable Structures: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

**L1,L2,L3**

**Module – 4**

Slope Deflection Method: Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3

**L1,L2,L3,L4 08Hours**

**Module – 5**

| |
|---|
| Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3 **L1,L2,L3,L4 08Hours** |
| Teaching-Learning Process: |
| 1.Blackboard teaching/PowerPoint presentations (if needed)<br>2.Regular review of students by asking questions based on topics covered in the class. |

Course Outcomes: At the end of the course, the student will be able to
1. Identify the different forms of structural systems and analyse the trusses.
2. Evaluate the slope and deflections in beams, frames and trusses by using moment area method and energy principle.
3. Analyse and determine the stress resultants inarches and cables.
4. Analyse the indeterminate structures and construct BMD AND SFD using slope deflection methods.
5. Analyse the indeterminate structures and construct BMD AND SFD using Moment Distribution Method.

**Assessment Details**

CIE :

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 subquestions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1. | Basic Structural Analysis | Reddy C S | Tata McGraw Hill | Third Edition |
| 2. | Basic Structural Analysis | Muthu K U. etal, | IK International Pvt. Ltd | Second edition |
| 3. | Structual Analysis | Bhavikatti | Vikas Publishing House | Third Edition |
| Reference Books | | | | |
| 1 | Structual Analysis | Hibbeler R C | Prentice Hall | 9th edition |
| 2 | Structual Analysis | Devadoss Menon | NarosaPublishing House | 2008 |
| 3 | Structual Analysis | Prakash Rao D S, | University Press | 2007 |
| | | | | |

**e-Resources:**

•https://nptel.ac.in/courses/105105166
•https://nptel.ac.in/courses/105105166
•https://nptel.ac.in/courses/105105109
•https://nptel.ac.in/courses/105105109
•https://nptel.ac.in/courses/105105109

**IV-Semester**

Name of the Laboratory: BUILDING MATERIALS TESTING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code:** | **22CVL45** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

**Course Objectives:**
1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

**List of Experiments:**

| SN | Experiments |
|---|---|
| 1 | Tension test on mild steel and HYSD bars. |
| 2 | Compression test on mild steel, cast iron and wood. |
| 3 | Torsion test on mild steel circular sections |
| 4 | Bending Test on Wood Under two point loading |
| 5 | Shear Test on Mild steel- single and double shear |
| 6 | Impact test on Mild Steel (Charpy&Izod) |
| 7 | Hardness tests on ferrous and non-ferrous metals- Brinell’s, Rockwell and Vicker’s |
| 8 | Tests on Bricks :Dimensionality of bricks, Water absorption, Initial rate of absorption and compressive strength. |
| 9 | Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking |
| 10 | Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis . |

**Course outcomes:** At the end of the course, the student will be able to
1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.
4. Communicate effectively the mechanical properties of materials.

5.Test the materials as per Indian code of practice

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Weightage** | **Max. Marks** |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | Total Marks | | 50 |

**Semester End Evaluation (SEE):**

• Group experiments - Tension test, compression test, torsion test and bending test.
• Individual Experiments - Remaining tests.
• Two questions are to be set - One from group experiments and the other as individual experiment.
• Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
• All exercises are to be included for practical examination.

**Suggested Learning Resources:**

● Seminars / Quiz (To assist in GATE Preparations)
● Demonstrations in Lab
● Self Study on simple topics
● Simple problems solving using Excel
● Virtual Lab Experiments

**REFERENCES:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1. | Testing of Engineering Materials | Davis, Troxell and Hawk | McGraw Hill | |
| 2. | Building and construction materials-Testing and quality control | M L Gambhir and Neha Jamwal | McGraw Hill | |
| 3. | Mechanical Testing of Materials | Fenner | George Newnes | Third Edition |
| Reference Books | | | | |
| 1 | Experimental Strength of Materials | Holes K A | English Universities Press Ltd | |
| 2 | Testing of Metallic Materials | Suryanarayana A K | Prentice Hall of I Pvt | 2008 |
| 3 | Material Testing Laboratory Manual | Kukreja C B, Kishore K. and Ravi Chawla | Standard Publishers & Distributors 1996 | 2007 |
| 4. | Relevant latest IS Codes | | | |

**e-resources:**

1.Strength of Materials web course by IIT Roorkee https://nptel.ac.in/courses/112107146/
2.Strength of Materials video course by IIT Kharagpur https://nptel.ac.in/courses/105105108/
3.Strength of Materials video course by IIT Roorkee https://nptel.ac.in/courses/112107147/18
4.All contents organized http://www.nptelvideos.in/2012/11/strengthof-materials-prof.html

**Semester: IV**

**Course Name: TOTAL STATION LAB**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV472** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

**Course Learning Objectives:** This course will enable students to
1. Apply the basic principles of engineering surveying and measurements
2. Follow effective field procedures required for a professional surveyor
3. Use techniques, skills and advance surveying instruments necessary for engineering practice.

## LIST OF EXPERIMENTS

Introduction to Total Station, Parts of total station, Prism Reflector, types of Prism Reflector, topographical Survey, various functions in total station.

1. Instrument setup and Temporary adjustments of total station.
2. Distance and Angle measurement by using Total Station.
3. Determination of area using total station.
4. Profile Levelling by using total station.
5. Block Contouring using total station.
6. Determination of remote height using total station (Prism mode and Non prism mode).
7. Distance, gradient, difference in height between two accessible points using total station.
8. Topographical Survey using total Station.
9. Stake out using total station.

**Course Outcomes:**
After a successful completion of the course, the student will be able to:
1. Understand Total Station Operations.
2. Apply the basic principles of engineering surveying and measurements
3. Follow effective field procedures required for a professional surveyor
4. Use techniques, skills and advance surveying instruments necessary for engineering practice.
5. Execute Topographical Surveys and Stakeouts

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | Total Marks | | 50 |

**Semester End Evaluation (SEE):**

• All are individual experiments.

• Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.

• All exercises are to be included for practical examination

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | SurveyingVol.1 | B.C.Punmia | LaxmiPublication spvt.Ltd | 2009 |
| 2. | Surveying and Leveling Part I, | Kanetkar T P and S V Kulkarn | Pune Vidyarthi Griha Prakashan, | 1998 |

**Semester: IV**

**Course Name: ELECTRONIC WASTE MANAGEMENT - ISSUES AND CHALLENGES**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV473** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **1:0:0** | **SEE Marks** | 50 |
| **Credits** | **01** | **Exam Hours** | 01 |

- **Pre-requisites:**
- Waste management
- Health and environmental risks
- Types of waste generated.

**Course objectives:**

- To provide students with a comprehensive understanding of e-waste and its impact on the environment.
- To familiarize students with the generation, composition, and hazardous components of e-waste.
- To highlight the health and environmental risks associated with improper e-waste management.
- To introduce students to various methods of e-waste collection, recycling, and disposal.
- To develop an understanding of the relevant policies and regulations governing e-wastemanagement in India.

**Module – 1**

| |
|---|
| Introduction to E-Waste Management, Overview of e-waste and its impact on the environment, **(RBT Levels: 1,2)** |
| |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module - 2**

| |
|---|
| E-Waste Generation and Composition, Types of e-waste and their components **(RBT Levels: 1,2)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module - 3**

| |
|---|
| E-Waste Hazards and Environmental Impacts, Health and environmental risks associated with e-waste **(RBT Levels: 1,2)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 4**

| |
|---|
| E-Waste Collection and Recycling, Methods of e-waste collection, recycling, and disposal **(RBT Levels: 1,2)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 5**

| |
|---|
| E-Waste Management Policies and Regulations, Relevant laws, policies, and regulations in India **(RBT Levels: 1,2)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Course outcomes (Course Skill Set):**

At the end of the course the student will be able to:

1. Explain the concept of e-waste and its significance in the context of environmental sustainability.
2. Identify and classify different types of e-waste and describe their components.
3. Recognize the potential health and environmental hazards associated with improper e-waste management.
4. Evaluate and apply appropriate methods for the collection, recycling, and disposal of e-waste.
5. Demonstrate knowledge of the existing policies, regulations, and frameworks for e-waste management in India



**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| **1** | "E-Waste Management: From Waste to Resource" | R. K. Rathore and H. N. Chanakya | TERI Press | 2019 |
| **2** | "E-Waste in India: An Emerging Crisis" | Sangeeta Sharma | Cambridge Scholars Publishing | 2019 |
| **3** | "E-Waste Management: Research, Technology, and Applications", , | Majeti Narasimha Vara Prasad | CRC Press | 2016 |
| **Reference Books** | | | | |
| **1** | "Electronic Waste Management and Treatment Technology" | Rezaul Begg, R. M. Sarcar, and R. V. R. Singh | Springer | 2018 |
| **2** | "E-Waste Management: From Waste to Resource" by | Florin-Constantin Mihai, | Academic Press, | 2018 |

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning&Case study to understand the project finance concept.

**SEE**

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (Multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

**OR**

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.
2. There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.

**Semester: IV**

**Course Name: Technical Writing Skills**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV474** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **1:0:0** | **SEE Marks** | 50 |
| **Credits** | **01** | **Exam Hours** | 01 |

**Course objectives:**

- Achieve better Technical writing and Presentation skills for employment.
- Develop adequate knowledge of paragraph writing and precise writing techniques
- Write business proposals and reports.
- Write conference papers and prepare gist of published papers.
- Develop efficiency in drafting social media posts and blogs.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video
3. Practice sessions.

**Module-1**

**Technical Report Writing:** Introduction to Technical writing process, Understanding of writing process, Introduction to various Technical Report writing.

**Module-2**

**Art of condensation and Paragraph Writing:** Introduction and importance, Types and principles of condensation. Importance of paragraph writing, Features and its construction styles.

**Module-3**

**Business Report Writing:** Introduction, Definition and Salient features of Business reports. Significance and types of report writing. (Formal and Informal). Resume building and Types of resumes. (samples of resumes)

**Module-4**

**Technical Articles and Proposals:** Nature and significance, Types of technical Articles Journal articles and conference papers. Elements of technical articles .Introduction to technical proposal writing, Purpose, importance, structure and types of technical proposals.

**Module-5**

**Social media posts and Blog Writing:** Ethics and practices of social media posts, Principles and fundamentals, Guiding principles for composition of articles, some common pitfalls. Maintaining common etiquette. Blogs and Blog writings strategies.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to:

1. Effectively communicate in technical matters.
2. Practice preparation of gist, abstract and notes from a technical article.
3. Prepare a business proposals and reports.
4. Write and respond in social media and write blogs.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Communication Skills | Sanjay Kumar and Pushpalata, | Oxford University Press. | 2018. |
| 2 | Effective Technical Communication | M. Ashraf Rizvi, | McGraw Hill, | 2018. |
| 3 | 'Technical Communication | Gajendra Singh Chauhan and et.al. | Cengage Publication, | 2018. |
| **Reference Books** | | | | |
| 1 | Technical Communication Principles and Practice | Meenakshi Raman, and Sangeeta Sharma | Oxford University Press, | 2018. |

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning&Case study to understand the project finance concept.

**SEE**

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (Multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

**OR**

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.

2. There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.

**Semester IV**

**Course Name: Concreting Techniques and Practices**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV461** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

1. Introduction about Concreting Techniques
2. Introduction about construction equipment’s

**Course objectives:**

This course will enable students to:
To present the basics of concrete and different materials used in it.
To impart knowledge on materials used in concrete, relevant Indian standard codes, and practical aspects on concreting activities at projects.
To explain the importance of making good quality concrete to build durable structures.
To introduce the Design of concrete mixes from the Industrial experiences at Sites and optimization of higher grades of Concrete.
To learn the best practices in concrete construction from industry’s decades of experiences, thumb rules, mitigation of concreting issues at Sites

**Module – 1**

| |
|---|
| Introduction to concrete, overview of materials- cement, low carbon cement, coarse aggregate and fine aggregate, and mineral admixture:- fly ash, GGBS, micro silica / silica fume, metakaolin / rice husk ash, composite cement and ultrafine materials, lab test - fineness of fly ash, recycled aggregate **8 Hours (RBT Levels: L1,L2,L3)`** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos, NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills |
| |

**Module - 2**

| |
|---|
| Water and chemical admixture: source, requirements, limits and testing Blending of aggregate -: Blending of fine and coarse aggregate, gradation for optimization and practical aspects. **8 Hours (RBT Levels: L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos, NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills |

**Module – 3**

| |
|---|
| Mix design - Volumetric mix design, mix design by absolute volume method, worked out practical examples based on industries experience at project sites over several decades, higher grades of concrete, high performance concrete, test on concrete: workability of concrete, flexural and compressive strength tests. **8 Hours (RBT Levels:L1,L2,L3)** |

| **Teaching-Learning Process:** |
|---|
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos , NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills |

**Module – 4**

| |
|---|
| Production of concrete-: batching plant, calibration, mixing and transportation of concrete handling of concrete at construction, ready-mix concrete, pumping, placing of concrete with boom placers, levelling, vibration and compaction, cold joints, finishing and curing and protection of concrete<br>**8 Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos , NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills |

**Module – 5**

| |
|---|
| Special types of concrete: self-compacting concrete, mass concrete, dry lean concrete, geopolymer concrete, pavement quality concrete, fiber reinforced concrete, composite concrete, lightweight concrete, ferrocement, shotcreteing, guniting, grouting, challenges faced at sites: plastic shrinkage cracks, plastic settlement, honey comb, bug holes, cover to concrete, do's and don’ts in concrete construction, site shoot, introduction on 3D printing.<br>**8Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos, NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills. |

| **Course Outcomes:** |
|---|
| 1 Evaluate the properties of concrete by conducting test on cement, aggregate and concrete (with & without admixtures) for using the data for Mix design procedures<br>2. Understand to Select and proportionate different materials used in a concrete mix including admixtures<br>3. Design a concrete mix as per requirement of construction project<br>4. Apply the best practices in concrete construction from industry’s requirement, thumb rules, mitigation of concreting issues at Sites.<br>5.understand self compacting special concrete for different applications |

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**SEE:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Concrete Technology | M. S. Shetty, S Chand, | New Delhi-110055. | E-Book .2019 |
| 2 | Concrete Technology. | M. L. Gambhir | Tata McGraw-Hill. | |
| **Reference Books** | | | | |
| 1 | "Advanced Construction Techniques and Equipment" | Dr. ManoranjanSamal | S.K. Kataria& Sons | |
| 2 | "Construction Techniques and Practices | Velumani. P, | SIA Publishers & Distributers Pvt Ltd | 2020. |
| 3 | IS 456, IS 269, IS 516, IS 1786, IS 1893, IS 12269, IS 9103, IS 8112 | IS | | |

**E-resource**E-learning content on L&T EduTech Platform.

**Semester IV**

**Course Name: Construction Equipment, Plants and Machinery**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV462** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

1. Introduction about construction equipment's
2. Introduction about tunneling equipment's

**Course objectives:**

This course will enable students to:

- To provide insight on the different functions and operations of different equipment and techniques during construction
- To impart knowledge on the various maintenance and safety to be considered during construction
- To acquire knowledge on the life cycle of a construction equipment
- To adopt mechanization in the Construction industry

**Module – 1**

Basics and Hydraulics of Construction Equipment: Introduction to Construction Equipment Functions, Operations of Construction Equipment Introduction to Four & Two Stroke Engine and their components- Introduction and Components to Automobiles. Introduction to Principles of Hydraulic- Calculation of Pressure, Force & Flow- Components of a Hydraulic System- Basic layout of Hydraulic System Applications of Hydraulics- Strand Jack Operation

**8 Hours (RBT Levels: L1, L2, L3)** `

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

**Module - 2**

Concreting, Earth Moving, Road Making and Quarry/Mining Equipment: Operations of a Batching Plant - Introduction and Components of Concrete Pump & Placer- Concrete PipelineLaying and Cleaning- Bulldozer- Classification and Components- Classification, Components and Attachments of Excavator- Backhoe Loader- Classification & components- Introduction and classification to Hot mix Plant Process of Asphalt Paver-PQC Paver- Classification & Components- Motor Grader Classification & Components- Horizontal Movement VehiclesQuarry/Mining

**8 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

**Module – 3**

| |
|---|
| Equipment Life Cycle Management: Life Cycle of an Equipment- Equipment Performance Parameters - Introduction to Maintenance- Types of Maintenance- Maintenance Practices.<br>**8 Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos , NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills |

**Module – 4**

| |
|---|
| Tunnelling Equipment / Piling Equipment: Introduction to Tunnel Boring Machines- Details and Operation of a Hard-Rock TBM Details of Earth Pressure Balance (EPB) TBM- Details and operation of Slurry TBM & Components- Hydraulic Grabs- Piling Rig<br>**8 Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos , NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills |

**Module – 5**

| |
|---|
| Mechanization and Digitalization in Construction and Safety in Construction Equipment: Importance of Digital Analytics- Digital Solution in Construction Projects- Importance of Mechanization - Railway Track Construction- Rebar Processing Machine- Operation of 22.07.2023 22.07.2023 Annexure-II 2 2 Mechanized Equipment- Introduction to 3D Concrete Printer- Importance of Safety- Various PPE & Purpose- Safety of Men & Machines at Work- Safety During Construction Activities Safety with Tools & Tackles<br>**8Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos, NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills. |

**Course Outcomes:**

1. Evaluate equipment and techniques required during construction
2. Understand the operation of a batching plant.
3. Analyse the equipment life cycle management.
4. Comprehend mechanization and digitalization in construction.
5. Understand the need of tunneling and its operations.

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 subquestions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Construction Equipment and management" | S.C.Sharma | | E-Book .2019 |
| 2 | "Construction Techniques and Practices | Velumani. P, | SIA Publishers & Distributers Pvt Ltd | 2020. |
| **Reference Books** | | | | |
| 1 | "Advanced Construction Techniques and Equipment" | Dr. ManoranjanSamal | S.K. Kataria& Sons | |

**E-resource:**L&TEduTech Platform.

## Semester: IV

**Course Name: Disaster Management and Mitigation**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV463** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

**Course objectives:**

This course will enable students to:

1. Able to understand depth of knowledge of resilience and risk reduction.
2. Identify the disaster-Prone Areas in India, preparedness and management.
3. Able to understand and adopt Disaster mitigation techniques.

### Module – 1

**Introduction:** Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**8 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

### Module - 2

**Repercussions of Disasters and Hazards:** Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines ,Landslides and Avalanches, Man- made disaster: Nuclear Reactor Meltdown ,Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

**8 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

### Module – 3

**Disaster Prone Areas in India:** Study of Seismic Zones; Areas Proneto Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

**8 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module – 4

**Disaster Preparedness and Management:** Preparedness: Monitoringof Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

**8 Hours (RBT Levels:L1,L2,L3)**

| **Teaching-Learning Process:** |
|---|
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos<br>4. Quiz/Assignments/Open book test to develop skills |

**Module – 5**

| |
|---|
| **Disaster Mitigation:** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation.<br>**8 Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching<br>2. Power point Presentation<br>3. Videos, NPTEL materials<br>4. Quiz/Assignments/Open book test to develop skills. |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Depth knowledge of resilience and risk reduction.
2. Understand the basic concepts of disaster management and hazards.
3. Able to understand depth of knowledge of resilience and risk reduction.
4. Identify the disaster Prone Areas in India, preparedness and management.
5. Able to understand and adopt Disaster mitigation techniques.

**Assessment Details**

CIE :

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**SEE:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Disaster Management in India: Perspectives, issues and strategies. | Nishith, R. and Singh, A.K | New Royal book Company. | |
| 2 | Disaster-mitigation: experiences and reflections | Sahni, P., DHAMEJA, A. and MEDURY, U | PHI Learning Pvt Ltd | 2001 |
| **Reference Books** | | | | |
| 1 | Disaster Administration And Management Text And Case Studies | Goel, S.L., | Deep & Deep Publication Pvt. Ltd., New Delhi. | 2009 |

**E-learning :**

1. https://nptel.ac.in/courses/124107010.
2. https://www.youtube.com/watch?v=gQxs2VJPf4o

**Semester: IV**

**Course Name: ALTERNATIVE BUILDING MATERIALS**

| | | | |
|---|---|---|---|
| **Course Code** | **22CV464** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3-0-0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

- **Building Materials & Construction**
- **Construction Site Visits**

**Course objectives:**

1. Understand environmental issues due to building materials and the energy consumption in manufacturing building materials.
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. Understand the alternative building technologies which are followed in present construction field.

**Module – 1**

**Environmental Implications of Buildings**

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings. BUILDINGS 9 Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

**(08 Hours)(RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk and talk, PPT presentations, Youtube videos

**Module - 2**

**Elements of Structural Masonry:**

Elements of Structural Masonry, Masonry materials, requirements of masonry units, characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

**Structural Masonry Mortars:** Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength,

| |
|---|
| Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load. |
| **08 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module - 3**

| |
|---|
| **Alternate Building Materials:** Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes. |
| |
| **08 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 4**

| |
|---|
| **Alternate Building Technologies:** Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique.<br>**Alternate Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.<br>**8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 5**

| |
|---|
| **Equipment for Production of Alternate Materials:** Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.<br>**8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Course Outcomes:**

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies.
5. Design a energy efficient building by considering local climatic condition and building material.

**Assessment Details**

CIE for the theory component of PCC: 30 marks

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks for theory component A+B | | | 50 |

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**

**SEE for PCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the PCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Alternative Building Materials and Technologies | KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao | New Age International pub | ---- |
| 2 | Structural Masonry” | Arnold W Hendry | Macmillan Publishers | ---- |
| **Reference Books** | | | | |
| 1 | Building Materials in Developing Countries | RJS Spence and DJ Cook | Wiley pub | |
| 2 | LEED India, Green Building Rating System | | IGBC pub | |
| 3 | IGBC Green Homes Rating System | | CII pub | |
| 4 | Relevant IS Codes | | | |

e-Resources:

**Scheme of Teaching and Evaluation for B.E Programs**
**With effect from the academic year 2021-22**
**Total Credits for B.E.: 160**
**Credits Distribution as per NEP 2020**

| SEM | HS | BS | ES | PC | PE | AEC | OE | PW | INT | SE | UHV | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | 20 |
| 2 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | 20 |
| 3 | 1 | 3 | - | 12 | - | 2 | - | - | - | - | - | 18 |
| 4 | 1 | 3 | - | 12 | - | 3 | - | - | 2 | - | 1 | 22 |
| 5 | 1 | - | - | 11 | 3 | 2 | 3 | - | - | - | - | 20 |
| 6 | 3 | - | - | 8 | 3 | 1 | 3 | 2 | 2 | - | - | 22 |
| 7 | - | - | - | 7 | 3 | - | 3 | 8 | - | - | - | 21 |
| 8 | - | - | - | 3 | - | - | - | - | 13 | 1 | - | 17 |
| **TOTAL** | **10** | **20** | **20** | **53** | **9** | **10** | **9** | **10** | **17** | **1** | **1** | **160** |

| S.No | Course Area | Credit Distribution |
|---|---|---|
| **1.** | Humanities Social Sciences including Management (HS) | 10 |
| **2** | Basic Sciences (BS) | 20 |
| **3.** | Engineering Sciences (ES) | 20 |
| **4.** | Professional Core (PC) | 53 |
| **5.** | Professional Electives (PE) | 09 |
| **6.** | Ability Enhancement Course (AEC) | 10 |
| **7.** | Open Electives | 09 |
| **8.** | Project Work (Mini/Major) | 10 |
| **9.** | Internship (INT) | 17 |
| **10.** | Seminar (SE) | 01 |
| **11.** | Universal Human Values (UHV) | 01 |
| 12. | Mandatory Non-Credit Course (MNC) | - |
| | Total | **160** |

**The above is based on the VTU guidelines and the AICTE Model Curriculum**

## Semester 5

| SL | Course category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | PCC | 21CV51 | Design of RC structural elements | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21CV52 | Structural analysis -II | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CV53 | Geotechnical Engineering | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CV541 | Professional Elective-1 | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CV552 | Open Elective-1 | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CVL56 | Environmental Engg LAB | Civil | Civil | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21CVL57 | Concrete & Highway Lab | Civil | Civil | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | AEC | 21ADA580 | Advanced Aptitude | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 09 | AEC | 21CV581 | Quality Control and Quality Assurance | Civil | Civil | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 10 | HS | 21ENV59 | Environmental Studies | Humanities/ Civil | Humanities/ civil | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| | | **Total** | | | | | | | **20** | | **500** | **500** | **1000** |

## Professional Elective – 1

| | | |
|---|---|---|
| 01 | 21CV541 | Hydrology and Irrigation Engineering |
| 02 | 21CV543 | Prefabricated Structures |
| 03 | 21CV542 | Alternative Building Materials |
| 04 | 21CV544 | Railway Harbors Tunnels & Airports |
| 05 | 21CV545 | Water Resources & Management |

Professional Elective Courses (PE): A professional elective (PE) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum students' strength for offering professional electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

## Open Elective -1

| | | |
|---|---|---|
| 01 | 21CV551 | Disaster Management and Mitigation |
| 02 | 21CV552 | Sustainable Materials & Green Buildings |
| 03 | 21CV553 | Photo grammetry & Remote Sensing |
| 04 | 21CV554 | Ecology & Environment |
| 05 | 21CV555 | Cartography & GIS concepts |

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.

## Semester 6

| SL | Course category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | HS | 21CV61 | Construction Management & Entrepreneurship | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21CV62 | Design of steel structural elements | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CV63 | Applied Geotechnical Engineering | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CV642 | Professional Elective- 2 | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CV651 | Open Elective-2 | Civil | Civil | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CVL66 | Geotechnical Engg LAB | Civil | Civil | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21CVL67 | Software Application Lab | Civil | Civil | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | PW | 21CVE68 | Extensive survey project | Civil | Civil | Two contact hours /week for interaction between the faculty and students | | | 2 | 3 | 50 | 50 | 100 |
| 09 | AEC | 21CV690 | Q GIS & Civil Software LAB | Civil | Civil | 0 | 0 | 2 | 1 | 02 | 50 | 50 | 100 |
| 10 | INT | 21INT691 | Summer Internship-II | Completed during the intervening period of IV and V semesters. | | | | | 2 | --- | 100 | - | 100 |
| | Total | | | | | | | | 22 | | 550 | 450 | 1000 |

### Professional Elective – 2

| | | |
|---|---|---|
| 01 | 21CV641 | Transportation Engineering |
| 02 | 21CV642 | Ground Improvement Techniques |
| 03 | 21CV643 | Solid waste Management |
| 04 | 21CV644 | Matrix Method of Structural Analysis |

### Open Elective -2

| | | |
|---|---|---|
| 01 | 21CV651 | Occupation Health & Safety |
| 02 | 21CV652 | Traffic Engineering |
| 03 | 21CV653 | Remote sensing & GIS |
| 04 | 21CV654 | Intelligent Transportation Systems |

**Semester: V**

**Course Name: DESIGN OF RC STRUCTURAL ELEMENTS**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV51** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **03** |

**Pre-requisites**

- Basic knowledge of Concrete and its mix design, properties of steel and concrete
- Basic knowledge of usage of IS 456-2000 and SP-16 codes

**Course objectives:**

1. Understand the concept of design philosophy and principles of limit states.
2. Identify the types of loads for different end conditions
3. Impart the culture of following the codes for strength for design of beams
4. To gain the knowledge of limit state design for slabs and staircases as per IS 456-2000
5. To understand the behavior of columns and footings subjected to eccentric load

**Module – 1**

| |
|---|
| **Introduction to working stress** Introduction to working stress method, Difference between Working stress and Limit State Method of design.<br>**Introduction limit State Design** Philosophy and principle of limit state design with assumptions. Introduction IS code (IS 456-2000, SP-16, American code). Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.<br>Limiting deflection **(Serviceability)**, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only.<br>**10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module - 2**

| |
|---|
| **Limit State Analysis of Beams:** Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear. **10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 3**

| |
|---|
| **Limit State Design of Beams:** Design of singly reinforced beams with check for shear, check for development length and other checks. Design of doubly reinforced beams and flanged sections without checks<br>**10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 4**

| |
|---|
| **Limit State Design of Slabs and Stairs**: Introduction to one way and two-way slabs, Design of cantilever, simply supported and one-way continuous slab. Design of two-way slabs for different boundary conditions. Design of dog legged and open well staircases.<br>**10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 5**

| |
|---|
| **Limit State Deign of Columns and Footings**: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load.<br>**10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Course Outcomes:**

1. CO1: **Apply** the concepts of design philosophy, and principles of limit state in the analysis of RC structures.
2. CO2: **Analyse** the forces and moments acting on RC elements using limit state method
3. CO3: **Design** the singly, doubly and flange RC beam sections for shear and torsion as per IS Code 456-2000.
4. CO4: **Design** slabs and staircases by using the limit state concepts as per IS Code 456-2000.
5. CO5: **Design** of column and footing for different loading conditions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Reinforced Concrete Design | Unnikrishnan Pillai and Devdas Menon | McGraw Hill | 3rd 2020 |
| 2 | Design of Concrete Structures” | N Subramanian | Oxford university Press | 4th 2013 |
| 3 | Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete) | H J Shah | Charotar Publishing House Pvt. Ltd. | 11th 2016 |
| **Reference Books** | | | | |
| 1 | P C Varghese | Limit State design of reinforced concrete | PHI, New Delhi | 2nd 2008 |
| 2 | W H Mosley, R Husle, J H Bungey | Reinforced Concrete Design | MacMillan Education, Palgrave publishers | 7th 2012 |
| 3 | Kong and Evans | “Reinforced and Pre-Stressed Concrete” | Springer Publications | - |
| | | | | |

**e-Resources:** https://nptel.ac.in/courses/105105105

**Reference code**

| | |
|---|---|
| IS 456-2000 | Plain and reinforced concrete - code of practice |
| SP-16 | Design aids for reinforced concrete |
| IS 875-1,2,3,4 | Code of practice for Design loads |
| ACI 318-19 | (Building Code Requirements for Concrete Design) |

**Semester V**

## Course Name: Structural analysis -II

| | | | |
|---|---|---|---|
| **Course Code** | **21CV52** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:** Engineering Mechanics & Strength of materials.

### Course objectives:

1. Apply knowledge of mathematics and engineering in calculating slope, deflection, and bending moment and shearforce using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems
5. Communicate effectively in design of structural elements.

### Module – 1

**Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation, analysis ofcontinuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

### Module - 2

**Moment Distribution Method:** Introduction, Definition of terms, Development of method, Analysis ofcontinuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

## Module – 3

**Kani's Method:** Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

## Module – 4

**Matrix Method of Analysis (Flexibility matrix):** Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

## Module – 5

**Matrix Method of Analysis (Stiffness matrix):** Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials.

**Course Outcomes:**

1. **Apply** knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection method
2. **Identify, formulate** and solve problems in structural analysis by moment distribution Method
3. **Analyze** structural system and interpret data for beams and frames by Kani's method.
4. **Analyze** the beams and indeterminate frames by Flexibility method.
5. **Analyze** the beams and indeterminate frames by system stiffness method

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | **Structural Analysis”,** | Hibbeler R C | Pearson Publication | |
| 2 | **“Structural Analysis: A Unified Approach”** | D S Prakash Rao, | Universities Press | |
| 3 | **“Indeterminate Structural Analysis”,** | K.U. Muthu, H. Narendraetal, | IK International Publishing Pvt. Ltd. | |
| **Reference Books** | | | | |
| 1 | **“Basic Structural Analysis”,** | Reddy C S, | Tata McGraw-Hill Publishing Company Ltd. | |
| 2 | **“Intermediate Structural Analysis”,** | Wang C K, | McGraw Hill, International Students Edition. | |
| 3 | **“Computational Structural Mechanics”,** | S.Rajasekaran and G. Sankarasubramanian | PHI Learning Pvt.Ltd. | |
| | | | | |

**e-Resources:** https://nptel.ac.in/courses/105105166

- https://nptel.ac.in/courses/105105166
- https://nptel.ac.in/courses/105105166
- https://nptel.ac.in/courses/105105109
- https://nptel.ac.in/courses/105105109
- https://nptel.ac.in/courses/105105109

**Semester: V**

**Course Name: GEOTECHNICAL ENGINEERING**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV53** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | 3-0-0 | **SEE Marks** | 50 |
| **Credits** | 03 | **Exam Hours** | 03 |

**Pre-requisites:**

- **The laws of mechanics.**
- **Different types of soil and its strata in India**
- **The basic properties like index and engineering properties of soils.**
- **Bearing capacity of soil**

**Course objectives:**

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and Terminologies associated with geotechnical engineering.
4. Assess the improvement in mechanical behavior by densification of soil deposits using compaction.
5. Model and measure strength-deformation characteristics and bearing capacity of soils

**Module – 1**

| |
|---|
| **Introduction:** Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phaserelationships, definitions and their interrelationships.<br>Determination of Index properties: Specific gravity, water content, in-situ density, relative density,particle size analysis (sieve and Hydrometer analysis).<br>Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970). |
| **(10 Hours)(RBT Levels: 1,2,3)** |
| |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module - 2**

| |
|---|
| Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illiteand Montmorillonite and their application in Engineering<br>**Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and |

| |
|---|
| number of passes, Proctor's needle, Compacting equipments and their suitability. **10 Hours (RBT Levels: 1,2,3)** |
| |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module - 3**

| |
|---|
| **Flow through Soils:** Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.<br>**Seepage Analysis:** Laplace equation, assumptions, limitation sand its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreatic line (Casagrande's method–with and without toe filter), flow throughdams, design of dam filters.<br>**Effective Stress Analysis:** Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 4**

| |
|---|
| **Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr– Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 5**

| |
|---|
| **Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidate on theory-assumptions and limitations. Governing differential Equation and solution (No derivation).<br>Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Course Outcomes:**

1. Determine the index properties of soil and hence classify the soil
2. Assess the compaction and effective stresses of soil
3. Determine the permeability of soils and assess the seepage in hydraulic structures
4. Evaluate shear parameters of the soil using shear tests
5. Analyze the consolidation characteristics of soil

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| **1** | "Soil Mechanics and Foundation Engineering | **PunmiaB.C** | Laxmi Publications Co., India. | 17th 2017 |
| **2** | "Basic And Applied Soil Mechanics" | **Gopal Ranjan and Rao A.S.R** | New age International Publisher | 1 January 2016 |
| **3** | Soil Mechanics And Foundation Engineering | **K. R. Arora** | STANDARD PUBLISHER DIST. | 7 December 2020 |
| **Reference Books** | | | | |
| **1** | "Principles of Geotechnical Engineering", | Braja, M.Das, | Cengage Learning, India | 8th 2016 |
| **2** | "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", | Murthy V.N.S., | CRC Press, New York | 7th2018 |

e-Resources: NPTEL videos: https://archive.nptel.ac.in/courses/105/101/105101201/

**Semester: V**

**Course Name: Hydrology & Irrigation Engineering**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV541** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3-0-0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites: Environmental engineering.**

**Course objectives:**

1. Concept of hydrology, components of hydrologic cycle, hydrologic processes such as precipitation, infiltration, evaporation and transpiration.
2. Estimation of runoff and use the concept of unit hydrograph.
3. Systems and methods of irrigation, crop water requirement.
4. Canals, canal alignment, design methods of canals.
5. Computation of reservoir capacity. Concepts of floods and droughts,

**Module-1**

| |
|---|
| **Hydrology:** Introduction, Global distribution of water and Indian water availability. Hydrologic cycle (Horton's) qualitative and engineering representation. **Precipitation:** Forms and types, measurement of rainfall using Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs. **Losses from Precipitation:** Evaporation process, factors affecting evaporation, measurement using IS class-A Pan, reservoir evaporation and control. Factors affecting Evapotranspiration. Infiltration, Factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to nearby sites |

**Module-2**

| |
|---|
| **Runoff:** Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. **Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module-3**

| |
|---|
| **Irrigation:** System of irrigation: surface and ground water, flow irrigation, lift irrigation. Methods of irrigation: surface, sprinkler and drip/micro irrigation.<br>**Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to nearby sites |

**Module-4**

| |
|---|
| **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.<br>**Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Regime channels, Design of canals by Lacey's and Kennedy's method<br>(No numerical examples).<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to nearby sites |

**Module-5**

| |
|---|
| **Flood Management:** Indian rivers and floods, Causes of floods, Alleviation, Levees and floodwalls, Flood ways, Channel improvement, Flood damage analysis.<br>**Drought Management:** Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning.<br>**Water harvesting:** rainwater collection, small dams, runoff enhancement, runoff collection, Restoration and rejuvenation of water bodies (ponds and lakes)<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, YouTube videos, visit to nearby sites |

**Course Outcomes:**

1. Provide a background in the theory of hydrological processes and their measurement
2. Estimate runoff and develop unit hydrographs.
3. Find the water requirement and frequency of irrigation for various crops.
4. Find the canal capacity and compute the reservoir capacity.
5. Analyse floods and droughts. Emphasize on the importance of conservation of water and water bodies.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| **1** | Engineering Hydrology | K. Subramanya | Tata McGraw Hill Publishers, New Delhi. | ---- |
| **2** | A Text Book of Hydrology” | Jayarami Reddy | Lakshmi Publications, New Delhi | ---- |
| **3** | Punmia and LalPandey | “Irrigation and Water Power Engineering” | Lakshmi Publications, New Delhi. | |
| **Reference Books** | | | | |
| **1** | “Hydrology” | H.M. Raghunath, | Wiley Eastern Publication, New Delhi. | ---- |
| **3** | “Water Resources and Water Power Engineering”-. Standard book house | . Modi P.N | Tata McGraw Hill Publishers, New Delhi | ---- |
| **4** | “Irrigation Engineering and Hydraulics”, | Sharma R.K., | Oxford & IBH Publishing Co., New Delhi. | ---- |

e-Resources: NPTEL videos

## Semester V

**Course Name: PREFABRICATED STRUCTURES**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV543** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

**Course objectives:**

This course will enable students to:
1. Understand modular construction, industrialized construction
2. Design prefabricated elements.
3. Understand various prefabricated construction methods

### Module – 1

**Introduction:** Need for prefabrication–Principles–Materials–Modular coordination–Standardization–Systems– Production–Transportation–Erection.

**10 Hours (RBT Levels: L1,L2,L3)`**

**Teaching-Learning Process:**

1 .Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

### Module - 2

**Prefabricated Components:** Behavior of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels–Columns–Shear walls.

10 **Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

### Module – 3

**Design Principles:** Disuniting of structures-Design of cross section based on efficiency of material used– Problems in design because of joint flexibility–Allowance for joint deformation.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module – 4

**Joint In Structural Members:** Joints for different structural connections–Dimensions and detailing–Design of expansion joints.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation

3. Videos
4. Quiz/Assignments/Open book test to develop skills

**Module – 5**

**Design For Abnormal Loads:** Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

**Course Outcomes:**

1. Use modular construction, industrialized construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the advanced construction methods and prefabricated elements in buildings.
5. Understand design for abnormal loads.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Building materials and components | | CBRI | 1990 |
| 2 | Knowledge based process planning for construction and manufacturing | Gerostiza C.Z., Hendrikson C. and Rehat D.R | Academic Press Inc. | 1994 |
| **Reference Books** | | | | |
| 1 | Precast concrete connection details | | Netherland Betor Verlag, | 2009 |

**Semester: V**

**Course Name: ALTERNATIVE BUILDING MATERIALS**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV542** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

- **Building Materials & Construction**
- **Construction Site Visits**

**Course objectives:**

1. Understand environmental issues due to building materials and the energy consumption in manufacturing building materials.
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. Understand the alternative building technologies which are followed in present construction field.

**Module – 1**

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|---|
| **Environmental Implications of Buildings**<br>Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings. BUILDINGS 9 Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.<br>**(10 Hours)(RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos |

**Module - 2**

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|---|
| **Elements of Structural Masonry:**<br>Elements of Structural Masonry, Masonry materials, requirements of masonry units, characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.<br>**Structural Masonry Mortars:** Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, |

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|---|
| Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load. |
| **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module - 3**

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|---|
| **Alternate Building Materials:** Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes. |
| |
| **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 4**

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|---|
| **Alternate Building Technologies:** Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique.<br>**Alternate Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.<br>10 **Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Module – 5**

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|---|
| **Equipment for Production of Alternate Materials:** Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk and talk, PPT presentations, Youtube videos, visit to near by sites |

**Course Outcomes:**

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies
2. Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies.
5. Design a energy efficient building by considering local climatic condition and building material.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| **1** | Alternative Building Materials and Technologies | KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao | New Age International pub | ---- |
| **2** | Structural Masonry” | Arnold W Hendry | Macmillan Publishers | ---- |
| **Reference Books** | | | | |
| **1** | Building Materials in Developing Countries | RJS Spence and DJ Cook | Wiley pub | |
| **2** | LEED India, Green Building Rating System | | IGBC pub | |
| **3** | IGBC Green Homes Rating System | | CII pub | |
| **4** | Relevant IS Codes | | | |

**Semester: V**

**Course Name: Railways, Harbor, Tunneling and Airport Engineering**

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|---|---|---|---|
| **Course Code** | **21CV551** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

**Pre-requisites:**

- Basic modes of transportation and use of railways, airways, tunnels and harbors.
- Effective utilization of transportation system in different modes of transportation.
- Basic mathematics which is required for design and computation of different elements.
- About super elevation and its considerations with respect to different parameters.

**Course objectives:**

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.

2.Learn different types of structural components, engineering properties of the materials,to calculate the material quantities required for construction

3. Understand various aspects of geometrical elements, points and crossings, significance of maintenance of tracks.

4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids

5. Apply design features of tunnels, harbors, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

**Module – 1**

**Module 1: Railway Planning**

Significance of Road, Rail, Air and Water transports, Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings (Functions, types and requirements)-Track Stress, coning of wheels, creep and defects in rails.

Route alignment surveys, conventional and modern methods-Geometric design of railways, gradient (types and grade compensation), super elevation, Points and Crossings(Explanation & Sketches of Right &Left hand turnouts only 10 **Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits.

**Module - 2**

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| **Module 2:** **Railway Construction and Maintenance**<br><br>Earthwork-Stabilization of track on poor soil, Calculation of Materials required for track laying-Construction and maintenance of tracks-Modern methods of construction & maintenance<br><br>Railway stations and yards and passenger amenities, Urban rail-Infrastructure for Metro, Mono and underground railways. 10 **Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits. |

**Module – 3**

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|---|
| **Module 3: Harbor and Tunnel Engineering**<br><br>Planning and Design of Harbors: Requirements, Classification, Location and Design Principles – Harbor Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.<br><br>Tunneling: Importance of tunneling, advantages, disadvantages, size and shape of the tunnel, tunneling methods in soils (with support and without support) and hard rocks, tunnel lining, tunnel drainage and ventilation and types.<br><br>**10 Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits. |



**Module – 4**

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| **Module 4:** **Airport Planning**<br><br>Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.<br><br>**10 Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits. Open book test to understand the concepts. |

**Module – 5**

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| **Module 5:** **Airport Design**<br><br>Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting. 10 **Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits |

**Course Outcomes:**

On the completion of this course students are expected to attain the following outcomes;

1. Distinguish the various components of different modes of transport.

2. Evaluate the different design components of railways, tunnel, harbor and airport

3. Sketch the different components, layout of railways, harbours, tunnels and airport

4. Execute and schedule the various construction and maintenance work of different modes of transport

5. Design the length, requirements and components of railway and runway orientation of an airport.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A Course in Railway Engineering | Saxena Subhash C and Satyapal Arora | Dhanpat Rai and Sons, Delhi. | |
| 2 | Railway Engineering | Satish Chandra and Agarwal M. M | Oxford University Press, New Delhi. | 2nd Edition |
| 3 | Airport Planning and Design | Khanna S K, Arora M G and Jain S S | Nemch and and Brothers, Roorkee. | |
| 4 | Transportation,Engineering, VolumeII:Railways,Airports,DocksandHarbours,Bridgesand Tunnels | C Venkatramaiah | Universities Press | Volume II |
| 5 | A Course in Docks and Harbor Engineering | Bindra S P, A | Dhanpat Rai and Sons, New Delhi. | |
| **Reference Books** | | | | |
| 1 | "AcourseinDocks&Harbour Engineering"., | Oza.H.P.andOza.G.H | Charotar Publishing Co. | |
| 2 | "A course in Railway Track Engineering". | Mundrey J. S. | Tata Mc Graw Hill.. | |
| 3 | " Dock and Tunnel Engineering", | Srinivasan R | | 26thEdition2013 |

**Semester: V**

Course Name: **Water Resources Management**

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|---|---|---|---|
| **Course Code** | **21CV545** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

**Pre-requisites:**

**Course objectives:**

1. Judge surface and ground water resources.
2. Address the issues of water resources management.
3. Learn the principles of integrated water resources management.
4. Understand the legal framework of water policy.
5. Know the different methods of water harvesting.

**Module – 1**

**Surface and Ground Water Resources:** Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage medium.

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module - 2**

**Water Resources Planning and Management:** Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning andmanagement Issues.

**10 Hours (RBT Levels: 1,2,3,4)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 3**

**Integrated Water Resources Management:** Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types andForms of Private Sector Involvement.

**h10 Hours (RBT Levels: 1,2,3,4,5)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module – 4**

**Water Governance and Water Policy:** Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation ManagementTransfer Policies and Activities – Legal Registration of

| |
|---|
| WUAs – Legal Changes in Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India. |
| **10 Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module – 5

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|---|
| **Water Harvesting and Conservation**: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural andUrban area. |
| **10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Course Outcomes:

1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.
4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Engineering Hydrology" | K. Subramanya, | Tata McGraw Hill Publishers, New Delhi. | 2017 |
| 2 | "Ground Water" | H.M. Raghunath, | Wiley Eastern Publication, New Delhi. | 2007 |
| 3 | "Water Resources Systems Planning and Management" | Daniel P. Loucks and Eelco van Beek | UNESCO Publication | 2005 |
| | | | | |
| **Reference Books** | | | | |
| 1 | " Integrated Watershed Management in the Global Ecosystem" | Lal, Ruttan | CRC Press, New York. | 1999 |
| 2 | "Integrated Watershed Management: Principles and Practice" | Heathcote, I. W. | John Wiley and Sons, Inc., NewYork. | 1988 |
| | | | | |

**E-Resources:** https://archive.nptel.ac.in/courses/105/108/105108081/
https://onlinecourses.nptel.ac.in/noc22_ce45/preview

## Semester V

**Course Name: Disaster Management and Mitigation**

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|---|---|---|---|
| **Course Code** | **21CV551** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:**

**Course objectives:**

This course will enable students to:

1. Understand modular construction, industrialized construction
2. Design prefabricated elements.
3. Understand various prefabricated construction methods

### Module – 1

**Introduction:** Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

### Module - 2

**Repercussions of Disasters and Hazards:** Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man- made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

### Module – 3

**Disaster Prone Areas in India:** Study of Seismic Zones; Areas Proneto Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module – 4

**Disaster Preparedness and Management:** Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos
4. Quiz/Assignments/Open book test to develop skills

**Module – 5**

**Disaster Mitigation:** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation.

**10 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Depth knowledge of resilience and risk reduction.
2. Understand the basic concepts of disaster management and hazards.
3. Able to understand depth of knowledge of resilience and risk reduction.
4. Identify the disaster-Prone Areas in India, preparedness and management.
5. Able to understand and adopt Disaster mitigation techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Disaster Management in India: Perspectives, issues and strategies. | Nishith, R. and Singh, A.K | New Royal book Company. | |
| 2 | Disaster-mitigation: experiences and reflections | Sahni, P., DHAMEJA, A. and MEDURY, U | PHI Learning Pvt Ltd | 2001 |
| **Reference Books** | | | | |
| 1 | Disaster Administration And Management Text And Case Studies | Goel, S.L., | Deep & Deep Publication Pvt. Ltd., New Delhi. | 2009 |

**Semester: V**

**Course Name: SUSTAINABLE MATERIALS & GREEN BUILDINGS**

| | | | |
|---|---|---|---|
| **Course Code** | **21CIV552** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Course objectives:** This course will enable students to:

1. Understand the Definition, Concept & Objectives of the terms cost effective construction and green building
2. Apply cost effective techniques in construction
3. Apply cost effective Technologies and Methods in Construction
4. Understand the Problems due to Global Warming
5. State the Concept of Green Building
6. Understand Green Buildings

**Module – 1**

**Introduction to the concept of cost effective construction** -Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime Pozolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials-Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials.

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits.

**Module - 2**

**Environment friendly and cost effective Building Technologies** - Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams –columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products – steel and plastic - Contributions of agencies - Cost ford - Nirmithi Kendra – Habitat

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits.

**Module – 3**

**Global Warming** – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials Green

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|---|
| Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits. |

**Module – 4**

| |
|---|
| **Green Building rating Systems-** BREEAM – LEED - GREEN STAR -GRIHA ( Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits & treatment plant. |

**Module – 5**

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|---|
| **Utility of Solar Energy in Buildings-**Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low EnergyCooling. Case studies of Solar Passive Cooled and Heated Buildings.<br>**Green Composites for Buildings-**Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environmentand Green Buildings. Green Cover and Built Environment<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby treatment plants RMC Plants |

**Course Outcomes:**

1. Comprehend sustainable design, climatology, shading system and analyze heat transfer mechanism in buildings.
2. Assess the design considerations and parameters for thermal comfort, visual comfort, indoor air quality and acoustics.
3. Develop solutions for energy efficiency, water efficiency and waste management in buildings.
4. Adopt green project management methodology and evaluate building life cycle assessment.
5. Implement green practices during construction and operation phase of the buildings for achieving green rating.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Green Building Fundamentals" | Harhara Iyer G | Notion Press | (4 April 2022) |
| 2 | "Green Building: Principles & Practices" | Dr. Adv. Harshul Savla | Notion Press | (28 October 2021) |
| **Reference Books** | | | | |

**E-Resources-**

- https://www.youtube.com/watch?v=THgQF8zHBW8
- https://www.youtube.com/watch?v=DRO_rIkywxQ

**Semester: V**

**Course Name: PHOTOGRAMMETRY AND REMOTE SENSING**

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|---|---|---|---|
| **Course Code** | **21CIV553** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **03** |

**Pre-requisites**

**Course objectives:** This course will enable students to:

1. Understand Photogrammetric Principles.
2. Apply Photogrammetric Techniques.
3. Employ Advanced Photogrammetric Tools.
4. Apply Remote Sensing in Diverse Contexts.
5. Interpret Remote Sensing Data.

**Module – 1**

| |
|---|
| Introduction to Photogrammetry Overview of Photogrammetry: Definition and Significance. Historical Development of Photogrammetric, Basic Principles of Stereoscopic Vision and Parallax, Types of Photogrammetry: Aerial, Terrestrial, Close-Range Cameras and Sensors for Photogrammetry. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits. |

**Module - 2**

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|---|
| Photogrammetric Data Acquisition and Processing Aerial and Satellite Imagery for Photogrammetry, Photogrammetric Measurements: Scale, Distance, Orientation Camera Calibration Techniques, Image Triangulation and Bundle Adjustment Digital Elevation Models (DEMs) and Orthophoto Generation. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits. |

**Module – 3**

| |
|---|
| Advanced Photogrammetric Techniques3D Point Cloud Generation and Processing Close-Range Photogrammetry for Object Reconstruction Photogrammetry in Cultural Heritage, DocumentationIndustrial and Engineering Applications of Photogrammetry, Integration of Photogrammetry with GIS and CAD Systems. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits. |

**Module – 4**

| |
|---|
| Introduction to Remote Sensing, Basics of Remote Sensing: Definition and Importance Electromagnetic Spectrum and Interaction with Earth's Surface, Remote Sensing Platforms: Satellites, Drones, Aircraft, Types of Remote Sensing Data: Visible, Infrared, Microwave Image Processing Techniques for Remote Sensing Data. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits & treatment plant. |

**Module – 5**

| |
|---|
| Remote Sensing Applications and Analysis, Image Interpretation and Classification Change Detection and Monitoring with Remote Sensing, Hyper-spectral and Multispectral Image Analysis, Radar Remote Sensing and Inter-ferometry Integration of Remote Sensing with Environmental Studies. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby treatment plants RMC Plants |

**Course Outcomes:**

**CO1-** Understand Photogrammetric Principles.

**CO2-** Apply Photogrammetric Techniques.

**CO3-** Employ Advanced Photogrammetric Tools.

**CO4-** Apply Remote Sensing in Diverse Contexts.

**CO5-** Interpret Remote Sensing Data.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Surveying - III | Dr. B.C. Punmia and A.K. Jain | | |
| **Reference Books** | | | | |
| 2 | Remote Sensing and Image Interpretation | Lillesand and Kiefer | Wiley | 2011 |

**E-Resources-**

- https://www.youtube.com/watch?v=THgQF8zHBW8
- https://www.youtube.com/watch?v=DRO_rIkywxQ

**Semester: V**

Course Name: **Ecology & Environmental**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV554** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **03** |

**Course objectives:**

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Environmental awareness programme for the in house campus.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills

**Module – 1**

| |
|---|
| Ecology: Classification of Ecosystems, Structure and Function of Ecosystems, Energy flow in Ecosystems, Ecological Niche and succession, Bio-geochemical cycles, Ecological Pyramids. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos. |

**Module - 2**

| |
|---|
| Aquatic and Terrestrial Ecosystems: Diversity and dominance Indices, Ecosystem Models. Lake Ecosystem: Trophic levels, nutrient loading, nutrient enrichment, Leibig's Law, control of eutrophication **10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos. |

**Module – 3**

| |
|---|
| Systems ecology and ecosystems modelling. biodoversity and ecological perspective - human benifits, threats, conservation preservation and protection. **10 Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos. |

**Module – 4**

| |
|---|
| Environmental Pollutlon and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, solid waste management, e-waste management Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanisation, Automobile pollution. Acid Rain Ozone Layer depletion. |

| |
|---|
| **10 Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos. |

**Module – 5**

| |
|---|
| Environmental Education and Information: Goals, Objectives and guiding principles of Environmental educations. Environmental educational Programs; Environmental Education in India. **10 Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos. |

## Course Outcomes:

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between biotic and a biotic component.
4. Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Environment & Ecology" | Majid Husain | GK Publications | 6th and 2022 |
| 2 | "Environment Ecology and Biodiversity" | Shiva Ignatius And Loyola Ignatius | Pearson India | January 2023 |
| 3 | Environment and Ecology | Vaishali Anand | McGraw Hill | 1st and 2020 |
| 4 | Environment And Ecology | R Rajagopalan | OakBridge | 2019 |
| **Reference Books** | | | | |
| 1 | Concepts of Ecology | Kormondy, " | Prentice Hall Publication, New Jersey. | I Edition, |
| 2 | Ecology - The Experimental Analysis of Distribution and Abundance | Krebs J | Harper International. | I Edition, |
| | | | | |

**E-Resources:** https://onlinecourses.nptel.ac.in/noc19_ge23/preview
https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ge23/

**Semester: V**

**Course Name: CARTOGRAPHY AND GIS CONCEPTS**

| | | | |
|---|---|---|---|
| **Course Code** | **21CIV555** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **03** |

**Course objectives:** This course will enable students to:

1. Understand Cartographic Principles.
2. Apply Cartographic Techniques.
3. Utilize GIS Fundamentals.
4. Manage GIS Data Effectively.
5. Explore Advanced GIS Applications.

**Module – 1**

Introduction to Cartography, Definition and Significance of Cartography, Historical Development of Cartography, Basic Map Elements: Title, Legend, Scale, North Arrow, Map Projections and Coordinate Systems, Map Design Principles

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits.

**Module - 2**

Cartographic Representation and Visualization, Data Classification for Mapping, Symbolization and Visualization Techniques, Thematic Mapping: Choropleth, Graduated Symbol, Proportional Symbol, Cartographic Generalization and Simplification, Interactive and Web Mapping.

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits.

**Module – 3**

Geographic Information Systems (GIS) Fundamentals, Introduction to GIS: Definition and Applications, Components of GIS: Data, Software, Hardware, People, Spatial Data Models: Vector and Raster, Data Sources and Acquisition for GIS, Basics of GIS Analysis: Buffering, Overlay, Spatial Queries.

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, You tube videos, Nearby construction site visits.

**Module – 4**

| |
|---|
| GIS Data Management, Data Input Methods: Digitization, GPS, Remote Sensing, Data Editing, Cleaning, and Quality Assurance, Spatial Database Design and Management, Metadata Creation and Documentation, Data Sharing and Geospatial Standards. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, you tube videos, Nearby construction site visits & treatment plant. |

**Module – 5**

| |
|---|
| Advanced GIS Applications, Spatial Analysis Techniques: Network Analysis, Spatial Interpolation, 3D GIS and Terrain Modeling, Geocoding and Location-Based Services, GIS in Urban Planning and Environmental Management, Integration of GIS with Remote Sensing and Cartography **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, You tube videos, Nearby treatment plants RMC Plants |

**Course Outcomes:**

**CO1-** Understand Cartographic Principles.

**CO2-** Apply Cartographic Techniques.

**CO3-** Utilize GIS Fundamentals.

**CO4-** Manage GIS Data Effectively.

**CO5-** Explore Advanced GIS Applications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | **Concepts of Cartography Remote Sensing and GIS** | Dr. K.K Maltier & Prof S.R Maltier | Rajesh Publications | 2019 |
| 2 | **GIS CARTOGRAPHY: A Guide to Effective Map Design.** | **Gretchen N. Peterson.** | CRC Press | 3rd Edition, 2020 |
| **Reference Books** | | | | |

**E-Resources-**

- https://www.youtube.com/watch?v=THgQF8zHBW8
- https://www.youtube.com/watch?v=DRO_rIkywxQ

**V Semester**

Name of the Laboratory: **ENVIRONMENTAL ENGINEERING LABORATORY**

| | | | |
|---|---|---|---|
| **Course Code** | **21CVL56** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(0:0:2)** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

**Course Objectives:**

This course will enable students,

1. To learn different methods of water & waste water quality 2. To conduct experiments to determine the concentrations of water and waste water 3. To determine the degree and type of treatment 4. To understand the environmental significance and application in environmental engineering practice

**List of Experiments:**

| SN | Experiments |
|---|---|
| 1 | Determination of pH |
| 2 | Determination of Acidity |
| 3 | Determination of Alkalinity |
| 4 | Determination of Chlorides |
| 5 | Determination of Calcium, Magnesium and Total Hardness |
| 6 | Determination of percentage of % of available chlorine in bleaching powder sample |
| 7 | Determination of Residual Chlorine |
| 8 | Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids. |
| 9 | Determination of Turbidity |
| 10 | Determination of Dissolved Oxygen |
| 11 | Determination of BOD. |
| 12 | Determination of COD(Demonstration) |
| 13 | Air Quality Monitoring (Demonstration) |
| 14 | Determination of optimum coagulant dosage using Jar test apparatus |

**Course outcomes:**

| |
|---|
| Course outcomes (Course Skill Set): |
| At the end of the course the student will be able to: |
| 1 Acquire capability to conduct experiments and estimate the concentration of different parameters |
| 2 Compare the result with standards and discuss based on the purpose of analysis. |

| |
|---|
| 3 Determine type of treatment, degree of treatment for water and waste water |
| 4 Identify the parameter to be analyzed for the student project work in environmental stream |

**Suggested Learning Resources:**

**Reference Books:**

1. IS codes-3025 series
2. Standard method for examination of water and waste water, APHA, 20th edition 3. Clair Sawyer and Perry McCarty and Gene Parkin, “Chemistry for Environmental Engineering and Science”, McGraw-Hill Series in Civil and Environmental Engineering.

## V Semester

Name of the Laboratory: **Concrete and Highway materials Laboratory**

| | | | |
|---|---|---|---|
| **Course Code** | **21CVL57** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

**Course Objectives:**

This course will enable students to

1. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. To learn the procedure of testing bituminous materials as per standard code recommendations
3. To relate material characteristics to various application of construction.

**List of Experiments:**

| SN | Experiments |
|---|---|
| | **Part-A- Concrete Lab**<br>**Tests on Cement:**<br>a. Normal Consistency<br>b. Setting time<br>c. Compressive strength<br>d. fineness by air permeability test<br>e. specific gravity<br><br>**2. Tests on Concrete:**<br>a. Design of concrete mix as per IS-10262<br>b. Tests on fresh concrete:<br>i. slump, ii. compaction factor and iii. Vee Bee test<br>c. Tests on hardened concrete:<br>i. compressive strength test, ii. split tensile strength test, iii. flexural strength test<br>d. NDT tests by re bound hammer and pulse velocity test.<br><br>3**. Tests on Self Compacting Concrete:**<br>a. Design of self-compacting concrete, As per Is 10262:2019<br>b. slump flow test,<br>c. V-funnel test<br>d. J-Ring test<br>e. U Box test and f. L Box test |

| | |
|---|---|
| | **Part B- Highway materials Lab**<br>1. **Tests on Aggregates**<br>a. Aggregate Crushing value<br>b. Los Angeles abrasion test<br>c. Aggregate impact test d. Aggregate shape tests(combined index and angularity number)<br>2. **Tests on Bituminous Materials**<br>a. Penetration test<br>b. Ductility test<br>c. Softening point test<br>d. Specific gravity test<br>e. Viscosity test by tar viscometer<br>f. Bituminous Mix Design by Marshal Method (Demonstration only)<br>**3. Tests on Soil**<br>a. Wet sieve analysis<br>b. CBR test |

**Course outcomes:**

| Course outcomes (Course Skill Set): |
|---|
| At the end of the course the student will be able to: |
| 1. Able to interpret the experimental results of concrete and highway materials based on laboratory tests |
| 2. Determine the quality and suitability of cement. |
| 3. Design appropriate concrete mix Using Professional codes. |
| 4. Determine strength and quality of concrete. |
| 5. Evaluate the strength of structural elements using NDT techniques. |
| 6. Test the soil for its suitability as sub grade soil for pavements. |

**Suggested Learning Resources:**
**Reference Books:**

1. Shetty M.S, “Concrete Technology”, S. Chand &Co. Ltd, New Delhi.
2. Mehta P.K, “Properties of Concrete”, Tata McGraw Hill Publications, New Delhi.
3. Neville AM, “Properties of Concrete”, ELBS Publications, London.
4. Relevant BIS codes.
5. S K Khanna, C E G Justo and A Veeraragavan, “Highway Materials Testing Laboratory Manual”, Nem Chand Bros, Roorkee.

**e-resources:** You tube Videos.

## Semester: V
## Course Name: Advanced Aptitude

| | | | |
|---|---|---|---|
| Course Code | **21ADA580** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:**
1. Fundamentals of Mathematics
2. Basic knowledge of Reasoning

**Module – 1: Numerical Ability Based** **03 Hours**

Simplifications, Squares and Square Roots, Cubes and Cube roots, BODMAS Rule, LCM, HCF, Fractions and Decimals

**Module – 2: Percentage Based** **03 Hours**

Percentages, Profit and Loss, Discounts, Simple Interest and Compound Interest

**Module – 3: Time Based** **03 Hours**

Time and Work, Pipes and Cisterns, Time and Distance, Trains, Boats and Streams

**Module – 4: Ratio Based** **03 Hours**

Ratio-proportion, Partnership, Averages and Ages

**Module – 5: Logical and Analytical Based** **03 Hours**

Seating Arrangement, Series, Analogy, Odd man out and Blood Relations

**Course Outcomes:**
**At the end of course students will be able to**
1. Analyze and solve questions based on logical thinking and critical reasoning.
2. Analyze and solve quantitative aptitude problems
3. Solve aptitude problems using fast track techniques
4. Solve puzzle based questions
5. Analyze and solve problems on numerical computation and numerical estimation

## Semester V

## **Course Name:** Quality Control and Quality Assurance

| | | | |
|---|---|---|---|
| Course Code | 21CV581 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 02 |

**Pre-requisites:**

### Course objectives:

1. Appreciate the concept of Quality
2. Articulate the Implication of Quality in construction
3. Implement QA & QC Programs
4. Realise the importance of QMS in Civil Engineering.

### Module – 1

**Overview of Quality:** Quality History, Quality Definition, Quality Inspection, Quality Control, Quality Assurance, Quality Engineering, Quality Management, Quality Gurus: Philip B. Crosby, W. Edwards Deming etc, PDCA Cycle, Costs associated with Quality, Reasons for Poor Quality **03 Hours (RBT Levels: L1,L2,L3)`**

**Teaching-Learning Process:**

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module - 2

**Quality Management:** Management Practices: TQM, Vision and Quality policy, Quality Function Deployment, Bench marking and performance evaluation, ISO 9000 Quality Management System, ISO 14000 Environmental Management System **03 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module – 3

**Statistical Quality Control:** Importance of SQC in construction, Statistical parameters: sampling, population and sampling, measure of variability, measure of central tendency, Recommendations of IS 456:2000 on sampling, testing and acceptance criteria for concrete **03 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module – 4

**QA and QC in Construction:** Errors in concrete construction; Frequency of material testing and reporting of basic construction materials (cement, sand, coarse aggregate, bricks, steel), Norms for accepting and rejecting criteria of basic construction materials as per relevant IS codes. **03 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

## Module – 5

On-Site Quality: Achieving quality at different stages of construction: Conceptual Design, Preliminary Design, Detailed Design, Construction, Testing, Commissioning, and Handover. Quality assessment of concrete through NDT: rebound hammer and USPV tests and guidelines for accepting and rejecting.

**03 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

**Course Outcomes:**

At the end of the course the student will be able to:
1. Realize the importance of quality in construction
2. Apply SQC techniques in different aspects of construction
3. Implement QMS programs at different levels of construction

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Concrete and Steel Construction, Quality Control and Assurance" | Mohamed A. El-Reedy | s, Taylor and Francis Group | |
| 2 | Quality Management in Construction Projects | Taylor and Francis Group | Taylor and Francis Group | |
| **Reference Books** | | | | |
| 1 | Concrete Technology | Ms Shetty | S Chand Publications | |

**E-resource: Study material and you tube videos on QA and QC**

## Semester V
## Course Name: Environmental Studies

| | | | |
|---|---|---|---|
| Course Code | **21ENV59** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |

**Pre-requisites:** Water supply and treatment engineering.

**Course objectives:**
1. Understand and evaluate the global scale of environmental problems
2. Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world

**Module – 1** **010 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Ecosystems (Structure and Function):** Forest, Desert, Wetlands, Riverine, Oceanic and Lake. **Biodiversity:** Types, Threats and Conservation of biodiversity. Forest Wealth, and Deforestation. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 2** **010 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Advances in Energy Systems (Merits, Demerits, Global Status and Applications):** Hydrogen, Solar, OTEC, Tidal and Wind. **Natural Resource Management (Concept and case-studies**): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 3** **010 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts,)**: Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 4** **010 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Global Environmental Concerns (Concept, policies and case-studies**): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 5** **010 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.IS. & Remote Sensing. Environment Impact Assessment. Environmental Management Systems. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, you tube videos. |

**Course Outcomes:**

1. **Understand** the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale. Estimate runoff and develop unit hydrographs.
2. **Develop** critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. **Demonstrate** ecology knowledge of a complex relationship between biotic and a biotic component**.**
4. **Apply** their ecological knowledge to illustrate and graph a problem.
5. Describe the realities that managers face when dealing with complex issues.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | **Textbooks** | | | |
| 1 | Environmental Studies | S M Prakash | Pristine Publishing House, Mangalore | 3rd Edition, 2018 |
| 2 | **Environmental Studies** | Benny Joseph | Tata Mc Graw-Hill, 2nd Edition | 2012 |
| 3 | Environmental Studies – From Crisis to Cure R | Rajagopalan | Oxford Publisher | 2005 |
| | | | | |
| 1 | Principals of Environmental Science and Engineering | Raman Sivakumar | Cengage learning, Singapur | 2nd Edition, 2005 |
| 2 | Environmental Science - working with the Earth | G.Tyler Miller Jr. | Thomson Brooks /Cole | 11th Edition, 2006 |
| 3 | Text Book of Environmental and Ecology | Pratiba Sing, Anoop Singh & Piyush Malaviya | Acme Learning Pvt. Ltd. New Delhi. | 1st Edition |

## Semester VI

**Course Name: CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV61** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

### Pre-requisites:

- Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
- Inculcate Human values to grow as responsible human beings with proper personality.
- Keep up ethical conduct and discharge professional duties.

### Course objectives:

This course will enable students to:

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality.
3. Keep up ethical conduct and discharge professional duties
4. Develop an entrepreneurial outlook and mind set along with critical skills and knowledge to

### Module – 1

**Management:** Characteristics of management, functions of management, importance and purpose of planning process, types of plans.
**Construction Project Formulation:** Introduction to construction management, project organization, management functions, management styles.
**Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path critical path method, PERT method, concept of activity on arrow and activity on node.

**10 Hours (RBT Levels: L1,L2,L3)`**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

### Module - 2

**Resource Management:** Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.
**Construction Equipment's:** classification of construction equipment, Estimation of ownership cost, operational and maintenance cost of construction equipment's. Selection of construction equipment and basic concept on equipment maintenance
**Materials:** material management functions, inventory management.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

## Module – 3

**Construction Quality, safety and Human Values:** Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

**HSE: Introduction** to concepts of HSE as applicable to Construction. Importance of safety in construction, Safety measures to be taken during Excavation , Explosives , drilling and blasting ,hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

**Ethics:** Morals, values and ethics, integrity, trustworthiness, work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

## Module – 4

**Introduction to engineering economy:** Principles of Engineering Economy, concept of microeconomics and macroeconomics, Problem solving and Decision making, Interest and Interest Factors: Interest rate, Simple interest, Compound interest, Cash- flow diagrams,
Exercises and Discussion.

**Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break-even analysis.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

## Module – 5

**Introduction to Entrepreneurship** – Entrepreneurship evolution concept, functions of an entrepreneurship, concepts, stages in entrepreneurial process.
Micro, small & medium enterprises (MSME): Def, characteristics, objectives, scope.
Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single window agency: SISI, NSIC, SIDBI, KSFC.

**Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

**Course Outcomes:**

1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence with time durations.
2. Analyze the labour output and equipment efficiency to allocate resources required for the construction project.
3. Identify the construction Quality, Safety measures to be adopted in the field of construction activities.
4. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value by interest formulas for comparing the alternative methods.
5. Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Principles of Management | P C Tripathi and P N Reddy“ | Tata McGraw-Hill Education | |
| 2 | K.K“Construction Project Management: Planning Scheduling and Control” | Chitkara | Tata McGraw Hill Publishing Company, New Delhi. | |
| 3 | | | | |
| **Reference Books** | | | | |
| 1 | Engineering Economics | R Panneerselvam, | Eastern Economy Edition | |

**E-resource:**https://archive.nptel.ac.in/courses/105/104/105104161/

**Semester VI**

Course Name: **Design of steel structural elements**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV62** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:** Engineering Mechanics & Design of RC Structures.

### Course objectives:

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behavior of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

### Module – 1

**Introduction:** Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

### Module - 2

**Bolted Connections:** Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1.Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

## Module – 3

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

## Module – 4

**Design of Tension Members:** Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

**Design of Column Bases:** Design of Simple Slab Base and Gusseted Base.

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

## Module – 5

**Design of Beams:** Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams. Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems].

**10 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

**Course Outcomes:**

1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel codeprovisions and plastic behavior of structural steel.
2. Design of Bolted and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | “Design of Steel Structures” | N Subramanian., | Oxford University Press, New Delhi | |
| 2 | “Limit State Method of Design of Steel Structures” | Duggal S K., | Tata McGraw Hill, New Delhi | |
| **Reference Books** | | | | |
| 1 | Design of Steel Structures” | Dayarathnam P, | Scientific International Pvt. Ltd. | |
| 2 | “Design of Steel Structures”, | Kazim S M A and Jindal R S, “ | Prentice Hall of India, New Delhi. | |
| 3 | General Construction in Steel Code Practice | IS 800-2007 | Bureau of Indian Standards, New Delhi. | |

**e-Resources:** Video Lectures https://nptel.ac.in/courses/105105162

- Lecture Notes https://nptel.ac.in/courses/105106112

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**Semester: VI**

Course Name: **Applied Geotechnical Engineering**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV63** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **3** |

**Pre-requisites:**

- The laws of mechanics.
- The basic properties like index and engineering properties of soils.
- The Shear strength concept of soils
- Compaction, consolidation and permeability of soils

**Course objectives:**

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geotechnology are applied in the design of foundations
2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. To study the lateral earth pressure for different earth structures.
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures

**Module – 1**

**Soil Exploration**: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module - 2**

**Stress in Soils:** Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.

**Foundation Settlement:** Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

**8Hours (RBT Levels: 1,2,3,4)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 3

| |
|---|
| **Lateral Earth Pressure:** Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction.<br>**Stability of Slopes** : Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts.<br>**10 Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

## Module – 4

| |
|---|
| **Bearing Capacity of Shallow Foundation**: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.<br>**8Hours (RBT Levels: 1,2,3,4,5)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. Open book test to understand the concepts. |

## Module – 5

| |
|---|
| **Pile Foundations:** Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).<br>**8Hours (RBT Levels: 1,2,3,4)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits Open book test to understand the concepts. |



## Course Outcomes:

1. Explain the different geotechnical site investigation methods for different civil engineering projects
2. Analyze the Stresses in soils due to different load conditions.
3. To compute lateral pressure distribution behind earth retaining structures
4. Estimate factor of safety against failure of slopes
5. Ability to determine bearing capacity of soil for shallow and deep foundations

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Basic And Applied Soil Mechanics" | Gopal Ranjan and Rao A.S.R | New age International Publisher | 1 January 2016 |
| 2 | "Soil Mechanics and Foundation Engineering | Punmia B.C | Laxmi Publications Co., India. | 17th 2017 |
| 3 | Soil Mechanics and Foundation Engineering, | K.R.Arora, | Standard Publisher Distributors, NewDelhi. | **7 December 2020** |
| | | | | |
| **Reference Books** | | | | |
| 1 | Foundation Analysis and Design" | Bowles J.E., | McGraw Hill Pub.Co.NewYork | 5th 2001 |
| 2 | "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", | Murthy V.N.S., | CRC Press, New York | 7th,2018 |
| | | | | |

**E-Resources:** https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce01/

**Semester: VI**

**Course Name: TRANSPORTATION ENGINEERING**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV641** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | 03 | **Exam Hours** | **03** |

**Pre-requisites:**

- Idea of different modes of transportation.
- Minimum knowledge about road development plans in India.
- Different types of roads observed in daily life.
- Students should have knowledge of drainage systems.

**Course objectives:**

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts

**Module – 1**

| |
|---|
| **Principles of Transportation Engineering:** Importance of transportation, Different modes of transportation. Characteristics of road transport, Importance of Roads in India, Current Road development programs in India. **Highway Development and Planning:** Highway Development in India, Highway Planning, Planning Surveys and Interpretation, Highway Planning in India. **Highway Alignment and Project preparation**: Highway Alignment, Engineering Surveys for Highway alignment, Drawings and Reports, Highway Projects, Preparation of Detailed Project Report. **10 Hours (RBT Levels: L1, L2)** |
| **Teaching-Learning Process:** |
| 1. Blackboard teaching/PowerPoint presentations (if needed)<br>2. Regular review of students by asking questions based on topics covered in the class. |

**Module - 2**

| |
|---|
| **Highway Geometric Design of horizontal alignment elements:** Cross sectional elements, Sight distance, Design of Horizontal alignment: super elevation, radius of curve. Design of vertical alignment. **Pavement Design:** Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples. **10 Hours (RBT Levels: L3,L4)** |
| **Teaching-Learning Process:** |

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

## Module – 3

**Pavement Materials:** Subgrade soil -desirable properties-HRB soil classification- determination of CBR and modulus of sub grade reaction with Problems. Aggregates- Desirable properties. Bituminous Binders & Mixes- Types, desirable properties. Pavement Quality concrete- Materials, Requirements.

**Pavement Construction:** General features, Embankment and Subgrade, Construction WBM, WMM, DBM and BC. Construction of CC pavements.

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.
3. Compliment the understanding of Pavement materials with Lab demos.
4. Plan for site visits for students, where pavement construction is going on.

## Module – 4

**Highway Drainage:** Significance and requirements, Surface drainage system and sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

**Highway Economics:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual Cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

**10 Hours (RBT Levels: L1,L2 &L4)**

**Teaching-Learning Process:**

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

## Module – 5

**Elements of Railways and Airport Engineering - Railways:** Introduction, classification of routes; railway gauge, coning of wheels and canting of rails, train resistance and hauling power; track components: rails, sleepers, fastenings, ballast and formation.

**Airports**: Introduction, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications, - Site selection- regional Planning. Orientation of runway by using wind rose diagram with examples

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.
3. Conduction of Basic traffic studies by students in the field.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conductnecessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of flexible pavement and drainage.
4. Design road geometrics, structural components of rigid pavement and drainage.
5. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Highway Engineering | S K Khanna and C E G Justo | Nem Chand Bros | 10th edition |
| 2 | Railway Engineering | Chandra S. and Agarwal M.M | Oxford University Press India. | 2nd edition |
| 3 | Transportation Engineering | K. Subramaniam | SciTech Publications, Chennai | |
| **Reference Books** | | | | |
| 1 | Highway Engineering | R Srinivasa Kumar | University Press | |
| 2 | A Course in Railway Engineering | Saxena Subhash C and Satyapal Arora, | Dhanpat Rai and Sons, Delhi. | |
| 3 | Highway Engineering | L R Kadiyali, | Khanna Publishers | |

**e-Resources:**

- http://nptel.ac.in/courses.php?disciplineID=111
- http://academicearth.org/

**VTU EDUSAT PROGRAMME – 20**

**Semester: VI**

**Course Name: GROUND IMPROVEMENT TECHNIQUES**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV642** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **03** |

## Pre-requisites:

- The laws of mechanics.
- The basic properties like index and engineering properties of soils.
- The Shear strength concept of soils
- Compaction, consolidation and permeability of soils

## Course objectives:

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, science and geotechnical engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and injection.

### Module – 1

| |
|---|
| Formation and Development of Ground: Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits; Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favorable ground conditions, Alternative Approaches, Geotechnical processes.<br>Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.<br>**10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module - 2

| |
|---|
| **Drainage Methods:** Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.<br>**Pre-compression and Vertical Drains:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading. **8Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module – 3

| |
|---|
| **Chemical Modification-I:** Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and |

deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.

**Chemical Modification-Ii:** Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

## Module – 4

**Vibration Methods:** Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibro flotation, sand compaction piles, stone columns, heavy tamping

**Grouting And Injection**: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

**8Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.Open book test to understand the concepts.

## Module – 5

**Geosynthetics:** Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,

**Miscellaneous Methods (Only Concepts & Uses):** Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles

**8Hours (RBT Levels: 1,2,3,4)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits Open book test to understand the concepts.



## Course Outcomes:

After studying this course, students will be able to:

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. Utilize properly the locally available materials and techniques for ground improvement so that economy inthe design of foundations of various civil engineering structures.
4. To understand the importance of vibration methods at deeper depths & grouting techniques.
5. To Understand different applications of geosynthetics and the miscellaneous concepts involved in ground improvement techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Ground Improvement Techniques | Purushothama Raj P | Laxmi Publications, New Delhi | 2016 |
| 2 | Ground Improvement Techniques | Nihar Ranjan Patra | **Vikas Publishing House** | **1 January 2012** |
| **Reference Books** | | | | |
| 1 | An Introduction to Soil Reinforcement and Geosynthetics | G L Shivakumar Babu | Universities Press (India) Pvt. Ltd | |
| 2 | Construction and Geotechnical Method in FoundationEngineering | Koerner R.M,“ | McGraw HillPub.C | |

**E-Resources:** https://nptel.ac.in/courses/105108075

**Semester VI**

**Course Name: Solid Waste Management**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV643** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites:** Water supply and treatment engineering.

**Course objectives:**

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions

## Module – 1

**INTRODUCTION TO SOLID WASTE MANAGEMENT:** classification of solid wastes (source and type based), solid waste management (SWM), elements of SWM, ESSWM waste management) and EST (environmentally sound technologies), factors affecting SWM, Indian scenario, progress in MSW (municipal solid waste) management in India≤3.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

## Module - 2

**WASTE GENERATION ASPECTS:** Waste stream assessment (WSA), waste generation and composition, waste characteristics (physical and chemic health and environmental effects (public health and environmental), comparative assessment of waste generation a composition of developing and developed nations, a case study results from an Indian city, handouts on soil compositions≤3.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

## Module – 3

**COLLECTION, STORAGE, TRANSPORT AND DISPOSAL OF WASTES:** Waste Collection, Storage and Transport: Collection components, storage-containers/collection vehicle transfer station, waste collection system design, record keeping, implementing collection and transfer system, a case study. Waste Disposal: key issues in waste options and selection criteria, sanitary landfill, landfill gas emission, leachate formation, environmental effects of landfill, landfill operation issues≤3.

**10 Hours (RBT Levels:L1,L2,L3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, NPTEL materials, You tube videos.

## Module – 4

| |
|---|
| **WASTE PROCESSING TECHNIQUES & SOURCE REDUCTION, PRODUCT RECOVERY & RECYCLING**: Purpose of processing. mechanical volume and size reduction, component separation, drying and dewatering. Sour Reduction, Product Recovery and Recycling: basics, purpose, implementation monitoring and evaluation reduction, significance of recycling. planning of a recycling program, recycling program elements, recycled materials and processes≤3. **10 Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, NPTEL materials, You tube videos. |

## Module – 5

| |
|---|
| **HAZARDOUS WASTE MANAGEMENT AND TREATMENT: Identification** and classification of hazardous waste, hazardous waste treatment, pollution prevention minimization, hazardous wastes management in India ≤3. **10 Hours (RBT Levels:L1,L2,L3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, NPTEL materials, You tube videos. |

### Course Outcomes:

1. **Apply** the basics of solid waste management towards sustainable development.
2. **Assess** the waste generation aspects and its case studies.
3. **Apply technologies** to process waste and dispose the same.
4. **Identify** waste processing techniques, source reduction, product recovery and recycling.
5. **Identify** waste processing techniques, source reduction, product recovery and recycling.

### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | **Integrated solid waste management** | Tchobaanoglous., Theisen | McGraw-Hill | 1993 |
| 2 | **Waste Management** | Blueskin B., Hard He G. | Springer | 1994 |
| **Reference Books** | | | | |
| 1 | **"Integrated solid waste management",** | White, | John Wiley & sons | 2001 |
| 2 | **"solid waste management and waste minimization technologies",** | Nicholas, | Elsevier | 2005 |
| | | | | |

**E-Resources:** https://onlinecourses.nptel.ac.in/noc23_ce66/preview

**Semester: VI**

**Course Name: MATRIX METHOD OF STRUCTURAL ANALYSIS**

| | | | |
|---|---|---|---|
| **Course Code:** | **21CV644** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |

**Pre-requisites**: Students should have knowledge about engineering mechanics such as resolving the force, composition of force, resultant of force, moment of force, moment of couple centroid and moment of inertia of plane areas.

### Module – 1

**Introduction:** Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements. **8Hours (RBT levels: 2,3,4)**

**Teaching-Learning Process:**

1.Blackboard teaching/PowerPoint presentations (if needed)
2.Regular review of students by asking questions based on topics covered in the class.

### Module - 2

**Element Flexibility Method:** Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses **8Hours (RBT levels: 2,3,4)**

**Teaching-Learning Process:**

1.Blackboard teaching/PowerPoint presentations (if needed)
2.Regular review of students by asking questions based on topics covered in the class.

### Module – 3

**Element Stiffness Method:** Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

**8Hours (RBT levels: 2,3,4)**

**Teaching-Learning Process:**

1.Blackboard teaching/PowerPoint presentations (if needed)
2.Regular review of students by asking questions based on topics covered in the class.

### Module – 4

**Effects of Temperature Changes and Lack of Fit:** Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.

**8Hours (RBT levels: 2,3,4)**

**Teaching-Learning Process:**

1.Blackboard teaching/PowerPoint presentations (if needed)
2.Regular review of students by asking questions based on topics covered in the class.

## Module – 5

| |
|---|
| **Direct Stiffness Method:** Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses. |
| **8Hours (RBT levels: 2,3,4)** |
| **Teaching-Learning Process:** |
| 1.Blackboard teaching/PowerPoint presentations (if needed)<br>2.Regular review of students by asking questions based on topics covered in the class. |

**Course Outcomes:**

1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
4. Evaluate secondary stresses.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1. | Matrix Analysis of Framed Structures | Weaver W and Gere J H, | CBS publications, New Delhi. | Third Edition |
| 2. | Computational Structural Mechanics",. | Rajasekaran S, | PHI, New Delhi | Second edition |
| 3. | Matrix and Finite Element Analysis ofStructures | Madhujit Mukhopadhay and Abdul Hamid Sheikh | Ane Books Pvt. Ltd. | Third Edition |
| Reference Books | | | | |
| 1 | Matrix Method of Structural Analysis. | Godbole P N et.al | PHI ltd, New Delhi | 9th edition |
| 2 | Theory of Structures | Pundit and Gupta, " | Vol II, TMH publicat New Delhi | 2nd edition |
| 3 | Advanced Structural Analysis | A K Jain, " | Nemchand Publications, Roorkee. | 2007 |
| 4 | Elements of Matrix Analysis and Stability of Structures. | Manikaselvam, " | Khanna Publishers, NewDelhi | 2008 |
| | | | | |

**E-resource:** https://archive.nptel.ac.in/courses/105/105/105105180/

**Semester: VI**

**Course Name: OCCUPATIONAL HEALTH AND SAFETY**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV651** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | **3** | **Exam Hours** | **03** |

**Pre-requisites**

- Basic knowledge of Safety at work place
- Basic knowledge of usage PPE

**Course objectives:**

1. Gain historical, economic, and organizational perspective of occupational safety and health;.
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify work place problems and safe work.
5. Identify the safety measurement at water treatment plant

**Module – 1**

| |
|---|
| **Occupational Hazard and Control Principles:** Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module - 2**

| |
|---|
| **Ergonomics at Work Place:** Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations. **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 3**

| |
|---|
| **Fire Prevention and Protection:** Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. **Electrical Safety, Product Safety**: Technical Requirements of Product safety **10 Hours (RBT Levels: 1,2,3)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

**Module – 4**

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability **10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits & treatment plant.

**Module – 5**

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

**10 Hours (RBT Levels: 1,2,3)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, YouTube videos, Nearby treatment plants RMC Plants

**Course Outcomes:**

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
5. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Occupational Safety and Health for Technologists, Engineers and Managers" | Goetsch D. L.,(1999) | Prentice Hall. | 8th 1999 |
| 2 | "Industrial Accident Prevention-A Scientific Approach" | Heinrich H.W.,(2007) | McGraw-HillBook Company National Safety Council and Associate (Data) Publishers Pvt. Ltd | 2007 |
| 3 | Industrial Safety and Pollution Control Handbook. | Nagaraj, J. | National Safety Council, 1992 | 2nd 1992 |

| Reference Books | | | | |
|---|---|---|---|---|
| 1 | Industrial Safety Management and Technology”, | Colling D.A.,(1990),“ | Prentice Hall, New Delhi. | (1990), |
| 2 | “Safety and Environmental Management” | Della D.E., and Giustina | International Thomson Publishing Inc | (1996), |
| 3 | | | | |
| | | | | |

**e-Resources-https://nptel.ac.in/courses/110105094**

**Semester: VI**

**Course Name: TRAFFIC ENGINEERING**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV652** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | 03 | **Exam Hours** | **03** |

**Pre-requisites:**

- Idea of different modes of transportation.
- Minimum knowledge about road development plans in India.
- Different types of roads observed in daily life.
- Students should have knowledge of drainage systems.

**Course objectives:**

**This course will enable students to**

1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analyzing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

**Module – 1**

**Traffic Planning and Characteristics:** Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

**10 Hours (RBT Levels: L1, L2)**

**Teaching-Learning Process:**

3. Blackboard teaching/PowerPoint presentations (if needed)
4. Regular review of students by asking questions based on topics covered in the class.

**Module - 2**

**Traffic Surveys:** Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service-Concept, applications and significance.

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

3. Blackboard teaching/PowerPoint presentations (if needed)
4. Regular review of students by asking questions based on topics covered in the class.

**Module – 3**

**Traffic Design and Visual Aids:** Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

5. Blackboard teaching/PowerPoint presentations (if needed)
6. Regular review of students by asking questions based on topics covered in the class.
7. Compliment the understanding of Pavement materials with Lab demos.
8. Plan for site visits for students, where pavement construction is going on.

**Module – 4**

**Traffic Safety and Environment**: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

**10Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

3. Blackboard teaching/PowerPoint presentations (if needed)
4. Regular review of students by asking questions based on topics covered in the class.

**Module – 5**

**Traffic Management**: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

**10Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

4. Blackboard teaching/PowerPoint presentations (if needed)
5. Regular review of students by asking questions based on topics covered in the class.
6. Conduction of Basic traffic studies by students in the field.

**Course Outcomes:**

**At the end of the course the student will be able to:**

1.Understand the human factors and vehicular factors in traffic engineering design.
2.Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3.Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Highway Engineering | S K Khanna and C E G Justo | Nem Chand Bros | 10th edition |
| 2 | Traffic Engineering and Transport Planning | Kadiyali. L.R | Khanna Publishers | Delhi,2013 |

| | | | | |
|---|---|---|---|---|
| 3 | Indian Roads Congress (IRC) Specifications | | Guidelines and Special Publications on Traffic Planning and Management | |
| 4 | Highway Traffic Analysis and design | Salter. R.I and Hounsell N.B | Macmillan PressLtd | 1996 |
| **Reference Books** | | | | |
| 1 | "Traffic Management Planning, Operations and control | John E Tyworth, | Addison Wesly Publishing Company | 1996 |
| 2 | "Guidelineson Low-cost Traffic Management Techniques" for Urban Areas | SP: 43-1994,IRCSpecification | | 1994 |
| 3 | Traffic Planning and Engineering | Hobbs.F.D | University of Brimingham,Peragamon Press Ltd | 2005 |

**e-Resources:**

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

**VTU EDUSAT PROGRAMME – 20**

**Semester: VI**

**Course Name: REMOTE SENSING AND GIS**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV653** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | 03 | **Exam Hours** | **03** |

### Prerequisite:

1. Basics of surveying

### Course objectives:

### This course will enable students to

1. Understand Remote Sensing Principles.
2. Analyze Remote Sensing Data.
3. Apply Advanced Remote Sensing Techniques.
4. Utilize GIS Fundamentals.
5. Manage GIS Data Effectively.

### Module – 1

| |
|---|
| Introduction to Remote Sensing, Overview of Remote Sensing: Definition and Significance, Historical Development of Remote Sensing, Basic Principles of Remote Sensing, Electromagnetic Spectrum and Data Acquisition. **10 Hours (RBT Levels: L1, L2)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module - 2

| |
|---|
| Remote Sensing Data Analysis, Types of Remote Sensing Data: Optical, Thermal, Microwave, Image Interpretation and Classification, Change Detection Techniques, Applications of Remote Sensing in Environmental Monitoring. **10 Hours (RBT Levels: L1,L2)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module – 3

| |
|---|
| Advanced Remote Sensing Applications, Hyperspectral and Multispectral Image Analysis, Radar Remote Sensing and Interferometry, LiDAR Technology and 3D Modeling, Case Studies in Remote Sensing Applications. **10 Hours (RBT Levels: L1,L2)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

### Module – 4

| |
|---|
| Introduction to GIS, Definition and Importance of GIS, Components of GIS: Data, Software, Hardware, People, Spatial Data Models: Vector and Raster, Data Sources and Acquisition for GIS. **10Hours (RBT Levels: L1,L2)** |
| **Teaching-Learning Process:** |
| Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits. |

## Module – 5

GIS Data Management and Analysis, Data Input Methods: Digitization, GPS, Remote Sensing, Data Modeling and Geodatabases, Spatial Analysis Techniques: Buffering, Overlay, Proximity Analysis, Web GIS and Online Mapping.

**10Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

Chalk & Talk, PPT presentation, YouTube videos, Nearby construction site visits.

**Course Outcomes:**

**Students will be able to,**

1. Understand Remote Sensing Principles.
2. Analyze Remote Sensing Data.
3. Apply Advanced Remote Sensing Techniques.
4. Utilize GIS Fundamentals.
5. Manage GIS Data Effectively.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Remote Sensing and Image Interpretation | Lillesand and Kiefer | Wiley | 2011 |
| 2 | Higher Surveying - III | Dr. B.C. Punmia and A.K. Jain | | |
| **Reference Books** | | | | |
| 1 | GIS CARTOGRAPHY: A Guide to Effective Map Design | Gretchen N. Peterson | 3rd Edition, 2020 | |

**Semester: VI**

**Course Name: INTELLIGENT TRANSPORTATION SYSTEMS**

| | | | |
|---|---|---|---|
| **Course Code** | **21CV654** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **(3:0:0)** | **SEE Marks** | **50** |
| **Credits** | 03 | **Exam Hours** | **03** |

**Pre-requisites:**

- Idea of different modes of transportation.
- Minimum knowledge about road development plans in India.
- Different types of roads observed in daily life.
- Students should have knowledge of drainage systems.

**Course objectives:**

This course will enable students to

- Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control.
- Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travellers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate commercial fleets and freight exchange, and automate driving and safety

**Module – 1**

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection

**10 Hours (RBT Levels: L1, L2)**

**Teaching-Learning Process:**

- Blackboard teaching/PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class.

**Module - 2**

Advanced traveler information systems; transportation network operations; commercial vehicle operations and intermodal freight.

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

- Blackboard teaching/PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class.

**Module – 3**

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

- Blackboard teaching/PowerPoint presentations (if needed)

- Regular review of students by asking questions based on topics covered in the class.
- Compliment the understanding of Pavement materials with Lab demos.
- Plan for site visits for students, where pavement construction is going on.

**Module – 4**

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility.

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

- Blackboard teaching/PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class.

**Module – 5**

Travel demand management, electronic toll collection, and ITS and road-pricing. Automated Highway Systems and Vehicles in Platoons –ITS in World – Overview of ITS Implementations in developed countries, ITS in developing countries.

**10 Hours (RBT Levels: L1,L2)**

**Teaching-Learning Process:**

- Blackboard teaching/PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class.
- Conduction of Basic traffic studies by students in the field.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Suggest the appropriate system/s in various functional areas of transportation.
2. Amalgamate the various systems, plan and implement the applications of ITS.
3. Understand application of information technology and telecommunication to control traffic.
4. Provide advance information to the travelers.
5. Create automatic handling of emergencies and to improve safety.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Intelligent Transportation Systems Planning | Choudury M A and Sadek A | Artech House. | |
| 2 | Intelligent Transport Systems | Pradip Kumar Sarkar, Amit Kumar Jain | PHI Learning Publishers | |
| **Reference Books** | | | | |
| 1 | “Perspective on ITS” | Sussman, J. M | Artech House Publishers, | 2005 |
| 2 | National ITS Architecture Documentation | US Department of Transportation | CDROM | 2007 |
| 3 | Decision Support Systems and Intelligent Systems | Turban. E and Aronson. J. E, | | |

**e-Resources:**

- https://nptel.ac.in/courses/105107210
- https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html

**VTU EDUSAT PROGRAMME – 20**

## VI Semester

Name of the Laboratory: **GEOTECHNICAL ENGINEERING LABORATORY**

| | | | |
|---|---|---|---|
| **Course Code** | **21CVL66** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

### Course Objectives:

This course will enable students to

1. To carryout laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

### List of Experiments:

| SN | Experiments |
|---|---|
| 1 | Specific gravity test (pyconometer and density bottle method).<br>Water content determination by oven drying method |
| 2 | Grain Size Analysis Sieve Analysis |
| 3 | In-situ density tests<br>Core-cutter method<br>Sand replacement method |
| 4 | Consistency limits<br>Liquid limit test (by Casagrande's and cone penetration method) Plastic limit test<br>Shrinkage limit test, |
| 5 | Standard compaction test (light and heavy compaction) |
| 6 | Co-efficient of permeability test<br>Constant head test<br>Variable head test |
| 7 | Shear strength tests<br>Unconfined compression test<br>Direct shear test<br>Laboratory vane shear test<br>Triaxial test(unconsolidated undrained test only) |
| 8 | Consolidation test: to determine preconsolidation pressure only (half an hour preloading-test). |
| | **Demonstration Experiments (For CIE)** |
| 9 | Field identification of soil |
| 10 | Hydrometer analysis, |
| 11 | Rapid moisture meter method. |
| 12 | Standard penetration test and boring equipment |

**Course outcomes:**

| Course outcomes (Course Skill Set): |
|---|
| At the end of the course the student will be able to: |
| 1. Physical and index properties of the soil |
| 2. Classify based on index properties and field identification |
| 3. To determine OMC and MDD, plan and assess field compaction program |
| 4. Shear strength and consolidation parameters to assess strength and deformation characteristics |
| 5. In-situ shear strength characteristics (SPT-Demonstration) |

**Suggested Learning Resources:**

**Reference Books:**

1. Punmia BC, Soil Mechanics and Foundation Engineering-(2017),16th Edition, Laxmi Publications co., NewDelhi. Lambe T.W.,“Soil Testing for Engineers”, Wiley Eastern Ltd., New Delhi.
2. BowlesJ.E.,“Engineering Properties of Soil and Their Measurements”,- McGraw Hill Book Co. NewYork.
3. Relevant BIS Codes of Practice:IS-2720series

**e-resources:** https://nptel.ac.in/courses/105101160

**VI Semester**

Name of the Laboratory: **SOFTWARE APPLICATION LABORATORY**

| | | | |
|---|---|---|---|
| **Course Code** | **21CVL67** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L: T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **03** |

## Course Objectives:

This course will enable students to

1) Use industry standard software in a professional set up.
2) Understand the elements of finite element modeling, specification of loads and boundary condition,performing analysis and interpretation of results for final design.
3) Develop customized automation tools.

**Module -1**

**Use of civil engineering software's:**

Use of Analysis software's (STAAD Pro v8i / ETABS) for:

1. Analysis of plane trusses, continuous beams, portal frames (For Nodal loads and element loads, Independent load cases and Load combinations).
2. 3D analysis of multistoried frame structures (For element loads, Independent load cases and Load combinations).

**Module -2**

**Project Management- Exercise on Project planning and scheduling of a building project using any project management software:**

a. Understanding basic features of Project management software

b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.

c. Identification of Predecessor and Successor activities with constrain

d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non-Critical paths, Project duration, Floats.

e. Study on various View options available

f. Basic understanding about Resource Creation and allocation

g. Understanding about Splitting the activity, linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project

**Module -3**

**Use of EXCEL spread sheets**:

Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two-way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation.

**Course outcomes:**

| | |
|---|---|
| CO-1 | Apply the fundamental concepts in the analysis of different structural elements. |
| CO-2 | Analyze 3D multistoried frame structures using analysis software. |
| CO-3 | Plan & Schedule of a building project using project management software. |
| CO-4 | Use spreadsheet to achieve various calculations in civil engineering field. |

**Question paper pattern:**

- The question paper will have 6 questions under 3 modules.
- There will be two full questions (with a maximum of two subdivisions, if necessary) from eachmodule.
- Each full question shall cover the topics under a module.
- Module-1: 50Marks, Module-2: 25 Marks. Module-3: 25 Marks.
- The students shall answer two full questions, selecting one full question from each module.

**Suggested Learning Resources:**
**Reference Books:**
Reference Books: Training manuals and User manuals and Relevant course reference books

**e-resources:**
https://www.youtube.com/watch?v=jlIUqJlqbhU
https://www.youtube.com/watch?v=iXjRmef0lag
https://www.youtube.com/watch?v=_WoCxFutyoI

**Semester: VI**

Course Name: **Extensive Survey Project**

| | | | |
|---|---|---|---|
| **Course Code** | **21CVE68** | **CIE Marks** | **100** |
| **Teaching Hours/Week (L:T:P)** | **Two contact hours/ week** | **SEE Marks** | **50** |
| **Credits** | **2** | **Exam Hours** | **50** |

**Course Learning Objectives:**

This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipment's.
3. Work in teams and learn time management, communication and presentation skills

**Note:**

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. Use of Total Station is compulsory for minimum of TWO projects.
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross-sectional diagrams, and capacity volume calculation by using relevant software's
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

Completed during the intervening period of V and VI semesters.

1. **NEW TANK PROJECTS**: The work shall consist of;
   - Reconnaissance survey for selection of site and conceptualization of project.
   - Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
   - Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
   - Design and preparation of drawing with report.

2. **WATER SUPPLY AND SANITARY PROJECT**: The work shall consist of;
   - Reconnaissance survey for selection of site and conceptualization of project.
   - Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   - Preparation of village map by using total station.
   - Survey work required for laying of water supply and UGD
   - Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
   - Design of all elements and preparation of drawing with report.

3. **HIGHWAY PROJECT**: The work shall consist of;
   - Reconnaissance survey for selection of site and conceptualization of project.

- Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
- Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
- Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

4. **RESTORATION OF AN EXISTING TANK**: The work shall consist of;
- Reconnaissance survey for selection of site and conceptualization of project.
- Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
- Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
- Design of all elements and preparation of drawing with report.

5. **TOWN/HOUSING / LAYOUT PLANNING**: The work shall consist of;
- Reconnaissance survey for selection of site and conceptualization of project.
- Detailed survey required for project execution like contour surveys
- Preparation of layout plans as per regulations
- Centerline marking-transfer of centre lines from plan to ground
- Design of all elements and preparation of drawing with report as per regulations

## Course Outcomes:

1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general. Establishing trust-based relationships in teams & organizational environment
5. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques Reference Books: Training manuals and User manuals Relevant course reference books.

**Reference Books:**

- Training manuals and user manuals
- Relevant course reference books

**Semester: VI**

**Name of the course: Q-GIS & CIVIL SOFTWARE LAB**

| | | | |
|---|---|---|---|
| **Course Code** | **21AEC690** | **CIE Marks** | **50** |
| **Teaching Hours/Week(L:T:P)** | **0:0:2** | **SEE Marks** | **50** |
| **Credits** | **01** | **Exam Hours** | **02** |

**Course Learning Objectives:** This course will enable students to

1. Use industry standard software in a professional set up.
2. Understand the elements of finite element modeling, specification of loads and boundary condition,performing analysis and interpretation of results for final design.
3. Able to provide the structural design to the stakeholder.
4. Develop customized automation tools.

**Module -1**

**Use of civil engineering software's:**

Use of Analysis and design software's (STAAD Pro v8i and STAAD RCDC) for:

1. Analysis of multistoried (G+1) residential and commercial frames structures (For load cases - Dead loads, Live load and Load combinations) using STAAD Pro v8i software.
2. Design of multistoried (G+1) residential and commercial frames structures (For load cases - Dead loads, Live load and Load combinations) using STAAD RCDC software.

**Module -2**

**GIS applications using open source software (Q-GIS)**

a. To create shape files for point, line and polygon features with a map as reference.
b. To create decision maps for specific purpose.

**Course Outcomes:** After studying this course, students will be able to:

Use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

**Question paper pattern:**

- The question paper will have 2 questions under 2 modules.
- There will be two full questions (with a maximum of two subdivisions, if necessary) from eachmodule.
- Each full question shall cover the topics under a module.
- Module-1: 70 Marks, Module-2: 30 Marks.
- The students shall answer two full questions, selecting one full question from each module.

**Reference Books:** Training manuals and User manuals and Relevant course reference books

**Semester: VI**

Course Name: **SUMMER INTERNSHIP-II**

| | | | |
|---|---|---|---|
| **Course Code** | **21INT691** | **CIE Marks** | **100** |
| **Teaching Hours/Week (L: T:P)** | **Industry oriented** | **SEE Marks** | **----** |
| **Credits** | **2** | **Exam Hours** | **----** |

**Course Learning Objective**:

This course will enable students to get the field exposure and experience.

Completed during the intervening period of IV and V semesters.

**1.** This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.

**2.** The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions

**3.** The industry/organization should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.

**4.** The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.

**5.** Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.

**6.** The College shall facilitate and monitor the student internship program.

**7.** The internship should be completed during vacation after IV and V semesters.

**Course Outcomes:**

| | |
|---|---|
| **CO-1** | Apply knowledge of the industry & skills learnt to classroom work. |
| **CO-2** | Acquire practical experience in industry. |
| **CO-3** | Recognize the areas for career and skill development. |
| **CO-4** | Develop the skills to enable life-long learning. |
| **CO-5** | Develop oral communication skills and develop technical reports ethically |

Assessment Details

**1. Integrated professional Core Courses (IPCC):**
**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| X | Total Marks for theory component A+B | | | 30 |

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| Y | Total Marks | | 20 |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***
SEE for IPCC Theory for **3 Hourss** duration

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks-20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**2. Professional Core / Basic Science Courses (PCC / BSC) Theory:**
**Continuous Internal Evaluation (CIE):**
**Final CIE Marks = (A) + (B) = 30 + 20 = 50**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (**A**) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (**B**) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Semester End Examination (SEE)**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE.
- Marks secured will be scaled down to 50.

3. **Professional Core Course (PCC) Lab:**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Weightage** | **Max. Marks** |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. **Marks distribution**: **Procedure** (15%) + **Execution** (70%) + Viva Voce (15%)

**Semester End Evaluation (SEE) for MC lab**

1. All laboratory experiments (Part A and Part B) are to be included for practical examination
2. Students can pick one experiment from the questions lot of Part A with equal choice to all the students in abatch.
3. Weightage of marks for Part A is 50% and Part B is 50%
4. Change of experiment is allowed only once for Part A and Part B. 15% marks allotted to the procedure part tobe made zero.
5. Marks distribution: Procedure (15%) + Execution (70%) + Viva voce (15%)

4. **Ability Enhancement Course (AEC)**:
**Assessment Details of CIE**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**
**SEE Guidelines for the Courses**

1. 21CV690- Q GIS & Civil Software Lab

1. The pattern of the question paper consists of 2 Modules.
2. Each Module contains two questions where the student needs to answer ONE full question from each module.
3. The time allotted for SEE is 02 hours

5. **SEE Guidelines for the Courses**
   a. 21CV581- Quality control & Quality Assurance
   b. 21ADA580-Advanced Aptitude
   c. 21ENV59-Environmental Studies

   1. SEE will be conducted with common question papers for the subject.
   2. SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 100 marks which will be scaled down to50 marks.
   3. Duration of the examination is 02Hours

# Scheme of Teaching and Evaluation for B.E - III & IV Semester

# CSE (ARTIFICIAL INTELLIGENCE)

## (2022 Scheme)

# B.E. in Computer Science (ARTIFICIAL INTELLIGENCE)
## Scheme of Teaching and Examinations - 2022
## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
## (Effective from the academic year 2023-24)

## III SEMESTER

| SN | Course | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours / Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical / Drawing | SDA | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22MDA31 | Graph theory and Discrete Mathematical Structures, Probability and Statistics | TD: Maths, PSB: Maths | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CA32 | Digital System Design and Computer Organization | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CA33 | Operating System | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CA34 | Data Structures and Applications | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CAL35 | Data Structures Lab | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CA36 | ESC / ETC / PLC<br>Object Oriented Programming With JAVA | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22SC37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC / SEC | 22CA38X | Ability Enhancement Course / Skill Enhancement Course - III | TD & PSB: CSE / AIML / CS[AI], CS[DS] | If the course is a Theory<br>1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | | | | | If the course is a Laboratory<br>0 | 0 | 2 | | 02 | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| **Total** | | | | | | | | | | **550** | **350** | **900** | **20** |

| Ability Enhancement Course – III | | | |
|---|---|---|---|
| 22CA381 | Unix and Shell Programming | 22CA382 | Version Controller with GiT |
| 22CA383 | R Programming | | |

## ADDITIONAL MATHEMATICS for Lateral Entry Students

| SN | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours / Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Lecture | Tutorial | Practical / Drawing | Self -Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | L | T | P | S | | | | | |
| 1 | 22MATDIP31 | ADDITIONAL MATHEMATICS-I | MATHS | 3 | 0 | 0 | | 03 | 100 | 00 | 100 | 0 |

## B.E. in Computer Science (ARTIFICIAL INTELLIGENCE)
## Scheme of Teaching and Examinations - 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

## IV SEMESTER

| SN | Course and Course Code | | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours / Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical / Drawing | Self-Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22BB41 | Biology for Engineers | TD & PSB: | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CA42 | Principles Of Artificial Intelligence | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CA43 | Database Management Systems | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CA44 | Analysis and Design of Algorithms | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CAL45 | Algorithms Lab | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CA46X | ESC / ETC / PLC | TD & PSB: CSE / AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | AEC / SEC | 22PSW47 | Professional Skills for the Work Place | TD & PSB: H & S | If the course is a Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If the course is a Laboratory | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 8 | UHV | 22UH48 | Universal human values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | 22NS49 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE49 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Yoga | Yoga Teacher | | | | | | | | | |
| Total | | | | | | | | | | 500 | 400 | 900 | 20 |

| Engineering Science Course (ESC / ETC / PLC) | | | |
|---|---|---|---|
| 22CA461 | System Software | 22CA462 | Object Oriented Programming with Python |
| 22CA463 | Introduction to Data Analytics | | |

## ADDITIONAL MATHEMATICS for Lateral Entry Students

| SN | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours / Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Lecture | Tutorial | Practical / Drawing | Self -Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | L | T | P | S | | | | | |
| 1 | 22MATDIP41 | ADDITIONAL MATHEMATICS-II | MATHS | 3 | 0 | 0 | | 03 | 100 | 00 | 100 | 0 |

## Scheme of Teaching and Evaluation for

# B.E - III Semester

# CSE (ARTIFICIAL INTELLIGENCE)

## (2022 Scheme)

**Semester: III**

**(COMMON TO AIML & CS (AI) & CS (DA))**

## Course Name: GRAPH THEORY AND DISCRETE MATHEMATICAL STRUCTURES, PROBABILITY AND STATISTICS

| | | | |
|---|---|---|---|
| Course Code | **22MDA31** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
1. Definition of set, operations on sets and Definitions of different types of functions
2. First order Ordinary Differential Equations.
3. Statistics and probability

**Course objectives:**
1. Understand and explain the basic concepts of graph theory.
2. Understand an intense foundational introduction to fundamental concepts in discrete Mathematics.
3. Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Applying discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
6. Construct joint probability distributions.

**Module – 1** **08 Hours**

**Introduction to Graph Theory**
Definitions of degree, graph, incidence, Sub graphs, connected graphs, complete graph, Complement of a graph, and Graph Homorphism and Isomorphism. Bipartite graphs, Walks, paths and cycles. Hamiltonian and Euler Circuits.Planar graphs, Euler's formula (With Proof), Dual of a planar graph.
**Self-Study:** The Konigsberg bridge problem.
**Applications:** Internet filed. Google maps, webpage searching.

**Module – 2** **08 Hours**

**Relations and Functions:**
Definition of a relation, Matrix of a relation, Diagraph of a relation. Properties of relation. Equivalence relation (Theorems on Equivalence Relations). Partial ordered relation and poset. Least upper bound and greatest lower bound. Hasse diagram.
Compositions of functions, (Theorems on Composition functions). The pigeon hole principle., Permutation functions.
**Self-Study;** Invertible functions.
**Applications;** computer programme and coding.

**Module – 3** **08 Hours**

**Recurrence Relations;**
Definitions of a Recurrence relation. First Order Linear Recurrence Relation, and its applications The Second Order Linear Homogeneous Recurrence Relation, Non-homogeneous Recurrence Relation,
**Self-Study:** Generating Functions.
**Applications: A**To express the runtime complexity of an algorithm in a concise and mathematical form.

**Module – 4** **08 Hours**

**Statistical Methods and Curve Fitting:**
Correlation and regression- Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.
Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b, y = ax^b \ and \ y = ax^2 + bx + c$.
**Self-Study;** To fit the curve $y = ab^x, y = ae^{bx}$.
**Applications:** Data visualization, data analysis and data mining.

**Module – 5** **08 Hours**

**Probability Distribution;**
Review of Probability theory, Random variables (discrete and continuous), and Binomial and Poisson distribution their mean and variance (with proofs), mean and Normal distribution (without proof).
Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.
**Self-Study;** Exponential distribution.
**Applications:** Network traffic modeling.

**Course Outcomes:**
**CO1**: Know some important classes of graph theoretic problems.
**CO2:** Analyze the concepts of relations to various fields of Engineering.
**CO3:** Apply the concepts of functions and recurrence relations in the context of various fields of Computer Science Engineering, like, Database, finite Automata and formal languages, Compilers etc.
**CO4:** Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
**CO5:** Applying discrete and continuous probability distributions in analysing the probability models arising in engineering field and Construct joint probability distributions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Graph theory with applications to engineering and computer science | Narsingh Deo | Dover publishers | 1st Edition 2016 |
| 2 | Higher Engineering Mathematics, | B.S. Grewal | Khanna Publishers. | 44thEdition, 2017. |
| 3 | Advanced Engineering Mathematics | Erwin Kreyszig. | *Wiley Publications* | 10th Edition,2011 |
| 4 | Foundation of Discrete Mathematics | K D Joshi | *New* Age Publishers, Ltd | 10th Edition, 2014 |
| 5 | Discrete and Combinatorial Mathematics | Ralph P. Grimaldi | Pearson Education. Inc. | 5th Edition, 2011. |
| | | | | |

| Reference Books | | | | |
|---|---|---|---|---|
| 1 | Graph theory and combinatorics | Dr. D. Chandrashekar | Prism Publisher | 12th Edition 2010. |
| 2 | Higher Engineering Mathematics | B.V Ramana | Tata McGraw-Hill | 11th Edition,2010 |
| 3 | Discrete Mathematics and its applications | Kenneth H. Rosen | Tata McGraw-Hill, | 7th Edition,2012 |
| 4 | Discrete Mathematical Structures: Theory and Applications | D. S. Malik, M. K. Sen | Thomson Course Technology. | 1st Edition, 2004 |

**e-Resources:**
1. http://nptel.ac.in/ courses/ 111106050/ 13
2. https://www.youtube.com/ watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11
3. https://www.youtube.com/ watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index=13
4. https://www.youtube.com/ watch?v=7cTWea9YAJE&list=PL0862D1A947252D20&index=24.
5. https://www.youtube.com/ watch?v=695iAm935cY&list=PL0862D1A947252D20&index=25.
6. https://www.youtube.com/ watch?v=X0sGo7X2xHw.
7. https://www.youtube.com/ watch?v=7FJ08NILBuA

**Semester: III**

Course Name: **DIGITAL SYSTEM DESIGN AND COMPUTER ORGANIZATION**

| | | | |
|---|---|---|---|
| Course Code | **22CA32** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**
- Basic Electronics
- Basic Structure of Computer.

**Course objectives**
- Illustrate different simplifying techniques in the design of combinational circuits.
- Design various combinational and sequential digital circuits.
- Design various counters using Flip-Flops.
- Demonstrate the fundamentals of computer organization with machine instructions.
- Elaborate the communication of input / output devices with computer system and solve arithmetic Operations using various techniques.

**Module – 1** **08 Hours**

**Karnaugh Maps:** minimum forms of switching functions, two and three variable Karnaugh maps, four variable Karnaugh maps, determination of minimum expressions using essential prime implicants, Quine- McCuskey Method: determination of prime implicants, the prime implicant chart, simplification using map-entered variables

**Module – 2** **08 Hours**

**Multiplexers, Decoders and Programmable Logic Devices:** Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.
**Latches and Flip-Flops:** Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop, SR Flip Flop, J K Flip Flop, T Flip Flop.

**Module – 3** **08 Hours**

**Register and Counters:** Register and register transfers, Shift registers
**Counters:** design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops. Sequential parity checker

**Module – 4** **08 Hours**

**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance– Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes

**Module – 5** **08 Hours**

**Input / output Organization:** Accessing I / O Devices, Interrupts, Direct Memory Access, Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth algorithm.

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | a) Realize 3-Variable and 4-variable Boolean expressions, simplify it using K-map and Implement using basic gates.<br>b) Simulate and verify the working of above expressions using VHDL |
| 2 | a) Design and implement Half adder and Full Adder using basic gates.<br>b) Simulate and verify the working of Half adder and Full Adder using VHDL |
| 3 | a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer.<br>b) Simulate and verify the working of 8:1 multiplexer using VHDL |
| 4 | a) Design and implement the Binary to Gray Code converter using basic gates.<br>b) Simulate and verify the working of Binary to Gray Code converter using VHDL |
| 5 | a) Design and implement the Truth Table of a 3-bit Parity Generator and 4-bit Parity<br>b) Checker with an even parity bit using basic Gates. |
| 6 | a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.<br>b) Simulate and verify the working of D Flip-Flop with positive edge triggering using VHDL. |
| 7 | a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-flop ICs<br>b) Simulate and verify the working of mod-8 up counter using VHDL. |
| 8 | a) Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC7447).<br>b) Simulate and verify the working of Switched tail counter using VHDL |

**Course Outcomes:**
1. Apply different simplifying techniques in the design of combinational circuits.
2. Design various combinational and sequential digital circuits.
3. Design various counters using Flip-Flops.
4. Describe the fundamentals of computer organization with machine instructions.
5. Elaborate the communication of input / output devices with computer system and solve arithmetic Operations using various techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Analog and Digital Electronics | Charles H Roth and Larry L Kinney | Cengage Learning | 2019 |
| 2 | Computer Organization | Carl Hamacher, Zvonko Vranesic, Safwat Zaky | Tata McGraw Hill | 5th Edition 2002 |
| | **Reference Books** | | | |
| 1 | Digital Principles and Applications, | Donald P Leach, Albert Paul Malvino & Goutam Saha | Tata McGraw Hill, | 8th Edition 2015 |
| 2 | Computer Organization & Architecture, Pearson | William Stallings | | 9th Edition |

**e-Resources: 1. http: / / lms.vtu.ac.in / econtent / CSE.php**

## Semester: III
## Course Name: OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **22CA33** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Exam Hours | **3** |
| Credits | **4** | Total Marks | **100** |

**Pre-requisites:**
The students should have the knowledge of:
1. Basics of computer system and its applications
2. Basics of computer programming.

**Course objectives**
1. To introduce operating system, OS responsibilities, and OS services.
2. To discuss process concept, process scheduling techniques, and multi-threading concepts.
3. To demonstrate deadlock condition in the computer system, and usage of main memory.
4. To introduce virtual memory management concepts and file system.
5. To explain about secondary storage system and Linux OS as a case study.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems;
**Operating System Services**: User - Operating system interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating system structure; Virtual machines; System boot.

**Module - 2** **08 Hours**

**Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication.
**Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple- processor scheduling; thread scheduling.
**Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; threading issues.

**Module – 3** **08 Hours**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.
**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

**Module – 4** **08 Hours**

**Virtual Memory Management**: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.
**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Module – 5** **08 Hours**

**Secondary Storage Structures, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management.
**Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter- process communication.

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Install an operating system on a physical or logical (virtual) machine. |
| 2 | Design, develop and implement program to simulate the working of Shortest Remaining Time First scheduling algorithm. Experiment with different length jobs. |
| 3 | Design, develop and implement program to simulate the working of Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm. |
| 4 | Design, develop and implement a Banker’s algorithm. Assume suitable input required to demonstrate the results. |
| 5 | Design, develop and implement page replacement using FIFO algorithms. Assume suitable input required to demonstrate the results. |
| 6 | Design, develop and implement page replacement using LRU algorithms. Assume suitable input required to demonstrate the results. |
| 7 | Design, develop and implement optimal page replacement algorithms. Assume suitable input required to demonstrate the results. |

**Course Outcomes:**
At the end of the course students will be able to
1. Analyze the need, responsibilities, and services of OS.
2. Compare different process scheduling techniques.
3. Examine deadlock situation, prevention, avoidance and recovery.
4. Implement virtual memory management concept and file system.
5. Demonstrate the structure of secondary storage and design of Linux OS.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed, 2013. |
| 2 | An Introduction to Operating Systems: Concepts and Practice | P.C.P. Bhatt | PHI(EEE) | 4th Edition, 2014 |

**E-Resources:**
https: / / www.operating-system.org /
https: / / blog.feedspot.com / operating_system_blogs /
https: / / www.youtube.com / playlist?list=PLhqPDa2HoaAZLws7PFYWl4MnzCyHf8do-
https: / / medium.com / javarevisited / 6-best-operating-system-courses-for-beginners-to-learn- 7d727882d267

Semester: III

**Course Name: DATA STRUCTURES AND APPLICATIONS**

| | | | |
|---|---|---|---|
| Course Code | **22CA34** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **03** |

**Course objectives:**
1. Explain the fundamentals of data structures and their applications to solve real life problems.
2. Demonstrate the working of linear and nonlinear data structures.
3. Write solutions to problems using linear data structures and nonlinear data structures.
4. Apply different data structures to solve given problem.
5. Develop skills to apply appropriate data structures in problem solving.

**Module – 1** **08 Hours**

**Review of C Language:** Arrays, Structures & Unions, Pointers and Dynamic memory allocation **Introduction to Data Structures:** Classifications of Data Structures, Data structure operations: Traversing, inserting, deleting, searching and sorting.
**Applications:** Representation of Polynomials and Sparse Matrices

**Module – 2** **08 Hours**

**Stacks:** Stack Operations, Array Representation of Stacks, Different types of expression: Infix, Postfix and Prefix.
**Stack Applications:** Infix to postfix conversion, Infix to prefix conversion, Evaluation of postfix expression, Recursion.
**Queues:** Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeuers, Priority Queues.

**Module – 3** **08 Hours**

**Linked Lists:** Classification of linked lists. Representation of different types of linked lists in Memory. Traversing, Insertion, Deletion, Searching, Sorting and Concatenation Operations on Singly linked list. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues.
**Applications of Linked lists** – Polynomials, Sparse matrix representation.

**Module – 4** **08 Hours**

**Trees 1:** Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder;
**Threaded binary trees**
**Binary Search Trees:** Binary Search Trees, Insertion, Deletion, Traversal and Searching operations on Binary search tree. Application of Trees: - Evaluation of Expression.

**Module – 5** **08 Hours**

**Graphs:** Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
**Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

**Course Outcomes:**
1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | 2nd Ed, 2014 |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | 2nd Ed, 2014 |
| **Reference Books** | | | | |
| 1 | Data Structures using C | ReemaThareja | Oxford press | 3rd Ed 2012 |
| 2 | Data Structures using C | A M Tenenbaum | PHI | 2001 |

**Semester: III**
**Course Name: DATA STRUCTURES LAB**

| | | | |
|---|---|---|---|
| Course Code | **22CAL35** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **03** |

## List of Experiments

**Course Objectives:**
1. Illustrate implementation of basic operations on data structures.
2. Interpret Applications of different data structures.
3. Demonstrate data structures and their variants.
4. Illustrate various searching techniques using trees and graphs.
5. Develop skills to identify appropriate data structures to solve a given problem.

**Identify the functional requirements, then Design and Develop solutions to the problems related to the data structures**
1. Stacks and Queues
2. Linked list
3. Trees
4. Graphs
5. Hashing techniques

**Course outcomes:**
1. Design programs to implement basic operations on data structures.
2. Apply different data structures to solve problems.
3. Develop programs to demonstrate variants of queues and linked list
4. Implement various Searching techniques using trees and graphs.
5. Choose appropriate data structures to solve a given problem.

## Semester: III
## Course Name: OBJECT ORIENTED PROGRAMMING WITH JAVA

| | | | |
|---|---|---|---|
| Course Code | **22CA36** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **3** |

**Pre-requisites:**
Students should know the basic knowledge on:
- C Programming
- C++

**Course objectives**
1. Learn fundamental features of object-oriented language and JAVA.
2. Learn object-oriented concepts using programming examples.
3. Study the concepts of importing packages, exception handling mechanism and multithreading.
4. Introduce event handling mechanism.
5. Create Graphical User Interface (GUI) applications using swings.

**Module – 1** **08 Hours**

**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.
**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses. **Control Statements:** Java's Selection Statements, Iteration Statements

**Module - 2** **08 Hours**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, "This" Keyword, Garbage Collection.
**A Closer Look at Methods and Classes:** Overloading Methods.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class

**Module – 3** **08 Hours**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. **Exception Handling:** Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built- in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.
**Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(),Thread Priorities.

**Module – 4** **08 Hours**

**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model; Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes.

**Module – 5** **08 Hours**

| |
|---|
| **Introducing Swings:** The Origins of Swing, Two Key Swing Features, Components and Containers, The Swing Packages; A Simple Swing Application, Create a Swing Applet. **Exploring Swings:** J label and Image Icon, J Text Field, The Swing Buttons, J Tab bed pane, J List, J Combo Box, J Table. |

**Course Outcomes:**
1. Identify classes, objects, members of a class and relationship among them needed for a specific problem.
2. Implement reusability Programs in JAVA using inheritance.
3. Develop JAVA Programs of error handling techniques using exception handling.
4. Apply the concepts of event handling to develop GUI programs.
5. Apply the concepts of Java Swings to develop robust programs.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8thEdition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balaguruswamy | Tata McGraw Hill | 3rd Edition,2007 |

**e-Resources:**
How to install java*: https://youtu.be /IJ-PJbvJBGs*
Java Swings*:https://youtu.be /TwMXA1S38qg*
Java Quiz:https://www.w3schools.com /java /java_quiz.asp
Java Concepts:https://www.javatpoint.com /java-tutorial
Programming Exercises:https://www.programiz.com /java-programming /examples

**Semester: III**

Course Name: **SOCIAL CONNECT & RESPONSIBILITY**

| | | | |
|---|---|---|---|
| Course Code | **22SC37** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P: S) | **0:0:2** | SEE Marks | **--** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (No SEE – Only CIE) | **For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept. / Any Dept.** | | |
| Credits | **01 – Credit** | | |

**Course objectives:**

The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Contents:**

- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

**In the following a set of activities planned for the course have been listed:**

| **Contents** |
|---|
| **Part I:**<br>**Plantation and adoption of a tree:**<br>Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. |
| **Part II :**<br>**Heritage walk and crafts corner:**<br>Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes. |
| **Part III :**<br>**Organic farming and waste management:**<br>Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus |
| **Objectives, Visit, Case Study, Report, Outcomes.**<br>**Part IV:**<br>**Water conservation:**<br>Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes. |

| |
|---|
| **Part V :**<br>**Food walk:**<br>City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes. |

**Course outcomes (Course Skill Set):**

At the end of the course, the student will be able to:

CO1: Communicate and connect to the surrounding.
CO2: Create a responsible connection with the society.
CO3: Involve in the community in general in which they work.
CO4: Notice the needs and problems of the community and involve them in problem –solving.
CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Activities:**

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**PEDAGOGY:**

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs / social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

**COURSE TOPICS:**

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

**DURATION:**

A total of 40 - 50 hours engagement per semester is required for the 3rd semester of the B.E. / B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

**Guideline for Assessment Process:**
**Continuous Internal Evaluation (CIE):**
After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor / s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and / or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

**Excellent: 80 to 100**
**Good: 60 to 79**
**Satisfactory: 40 to 59 Unsatisfactory and fail : <39**

**Special Note:**
**NO SEE – Semester End Exam – Completely Practical and activities based evaluation**

**Pedagogy – Guidelines:**
It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

| SN | Topic | Group size | Location | Activity Execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Plantation and adoption of a tree: | May be individual or team | Farmers land / parks / Villages / roadside / community area / College campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 2. | Heritage walk and crafts corner: | May be individual or team | Temples / monumental places / Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 3. | Organic farming and waste management: | May be individual or team | Farmers land / parks / Villages visits / roadside / community area / College campus etc. | Group Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 4. | Water conservation: & conservation techniques | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 5. | Food walk: Practices in society | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Group Selection / Proper Consultation A / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |

**Plan of Action (Execution of Activities)**

| SN | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study based Assessment, Individual performance |
| 9 | Sector / Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities, compiled report should be submitted as per the instructions and scheme.

## Semester: III
## Course Name: UNIX AND SHELL PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **22CA381** | CIE Marks | **50** |
| Teaching Hours / Week (L: T; P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:** *Knowledge of DOS and Windows*

**Module – 1** **03 Hours**

**Introduction**, Brief history, Unix Architecture, Features of Unix, locating commands, Command structure, Internal and External commands, man command, Understanding the man documentation, **Basic commands** such as cal, date, echo, printf, passwd, who, wc, ls.

**Module - 2** **03 Hours**

**Unix files:** Basic file types, Parent-child relationship, the home directory, PATH variable. Relative and absolute pathnames.
**Directory commands** – pwd, cd, mkdir, rmdir commands,
**File related commands** – cat, cp, rm, mv.

**Module – 3** **03 Hours**

**File Types & Permission:**
The ls -l command, -d options, File ownership, File permissions, chmod, Directory permissions, changing File ownership.
**The vi editor:** Different modes of vi, Input mode commands, Command mode commands, ex- mode commands, Repeat command, Pattern searching, Search and Replace command.

**Module – 4** **03 Hours**

**The shells interpretive cycle**: Wild cards, Escaping and Quoting, Three standard files and redirection, Pipe, tee, Command substitution.
**Shell programming:** Ordinary and environment variables, read command, Command line arguments, exit and exit status of a command, Logical operators for conditional execution, test command and its shortcut, if, expr, while, for, and case-control statements, set and shift commands, positional parameters.

**Module – 5** **03 Hours**

**Process:** Basics, Mechanism of process creation, Parent and child process, The ps command with its options, Signals, Job control.
**File Links:** Hard link and soft link, umask, head, tail, cut, paste, sort and grep commands.

**Course Outcomes:**
1. Demonstrate the architecture and salient features of UNIX OS.
2. Understand UNIX Commands, Shell basic, and shell environments.
3. Create a file with vi editor and Apply changes in the file permission and ownership.
4. Design and develop shell programs using loops, and control statements.
5. Create UNIX Processes and a simple filter.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Unix Concepts and Applications | Sumitabha Das | Tata McGraw Hill | 4th Edition |

## Semester: III
## Course Name: VERSION CONTROLLER WITH GiT

| | | | |
|---|---|---|---|
| Course Code | **22CA382** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
- Basic knowledge of computer hardware and software
- Basic knowledge of programming

**COURSE OBJECTIVES**
1. To demonstrate the installation Git, set up their initial configuration, and comprehend the advantages and disadvantages of using Git for version control.
2. To illustrate the concept of creating and managing Git repositories
3. To implement branching concepts of Git including creating, merging, and switching branches, enabling them to effectively manage parallel development efforts
4. To illustrate setting up Git on a server, allowing them to facilitate collaborative development
5. To experiment with hosting repositories on GitHub, managing project issues there, and collaborating with others.

**Module – 1** **03 Hours**

**Getting Started:** Version Control Basics, What Is Git? Advantages Of Git, Disadvantages Of Git.
**The Basics:** Installing Git, First Time Git Set Up, Tips And Troubleshooting

**Module - 2** **03 Hours**

**Working with Repositories:** What Are Git Repositories?, Recording Changes To Repos, Working With Remotes, Git Aliases, Tagging

**Module – 3** **03 Hours**

**Working with Branches:** What Are Branches?, Branching And Merging, Branch Workflows, Remote Branches

**Module – 4** **03 Hours**

**Working with Servers:** Getting Git On Server, Server Setup, Distributed Git And Projects

**Module – 5** **03 Hours**

**GitHub:** What Is GitHub? History Of GitHub, How To Use GitHub, Different Types Of Accounts

**Course Outcomes:**
1. Install Git, set up their initial configuration, and comprehend the advantages and disadvantages of using Git for version control.
2. Gain proficiency in creating and managing Git repositories
3. Implement branching concepts of Git including creating, merging, and switching branches, enabling them to effectively manage parallel development efforts
4. Set up Git on a server, allowing them to facilitate collaborative development
5. Use GitHub as a platform for hosting repositories, tracking project issues, and collaborating with others

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Git: A Beginner's Guide | Sumanna Kaul, Shahryar Raz, and Divya Sachdeva | CRC Press | 2022 |
| **Reference Books** | | | | |
| 1 | Learning Git | Anna Skoulikari | O'Reilly Media | 2023 |
| 2 | Git Repository Management in 30 Days: Learn to manage code repositories like a pro | Sumit Jaiswal | BPB Publications | 2023 |
| 3 | Pro Git | Scoot Chacon | Apress | 2023 |

e-Resources:
https: / / pdfdrive.to / filedownload / mastering-git-a-beginners-guide-mastering-computer-science

**Semester: III**
**Course Name: R Programming**

| | | | |
|---|---|---|---|
| Course Code | **22CA383** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:** Knowledge of basic computer hardware, Software and any programming language

**Course objectives:**
1. Explore and understand how R and R Studio interactive environment.
2. To learn and practice programming techniques using R programming.
3. Read Structured Data into R from various sources.
4. Understand the different data Structures, data types in R.
5. To develop small applications using R Programming.

**Module – 1** **03 Hours**

**Numeric, Arithmetic, Assignment and Vectors**: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

**Module - 2** **03 Hours**

**Matrices**: Defining a Matrix, Sub-setting, Matrix Operations
**Conditions and Looping**: if statements, looping with for, looping with while, vector based programming.

**Module – 3** **03 Hours**

**Lists and Data Frames**: Data Frames, Lists: Special values, The apply family.

**Module – 4** **03 Hours**

**Programming with Functions -1**: Functions, scope and its consequences, Arguments.

**Module – 5** **03 Hours**

**Programming with Functions-2**: Vector Based programming using functions, Recursive Programming, Debugging functions

**Course Outcomes:**
1. Apply the fundamentals of R Programming to solve basic mathematical functions.
2. Design and Develop R programs using branching and iterative statements.
3. Apply critical programming concepts to solve real life problems.
4. Demonstrate R programs using functions.
5. Develop simple applications using Vector Based Programming.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Scientific Programming and Simulation Using R. Chapman & Hall / CRC | Jones, O., Maillardet. R. and Robinson.A | The R Series. | 2014 |
| **Reference Books** | | | | |
| 1 | Statistics: An Introduction using R | Michael J. Crawley | Wiley | Second edition, 2015 |

**e-Resources:**

Wickham, H. & Grolemund, G. (2018) for Data Science. O'Reilly: New York. Available for free at http: / / r4ds.had.co.nz.

R programming for Beginners; **https: / / www.youtube.com / watch?v=fDRa82lxzaU**

## Semester: III
## Course Name: NATIONAL SERVICE SCHEME (NSS) - (3rd to 6th)

| | | | |
|---|---|---|---|
| Course Code | **22NS39** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P) | **0:0:3** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (SEE) | Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th Semester) | | |
| Credits | NCMC – Non Credit Mandatory Course<br>(Completion of the course shall be mandatory for the award of degree) | | |

**Course objectives:**
National Service Scheme (NSS) will enable the students to:
1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**General Instructions - Pedagogy:**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

**National Service Scheme (NSS) – Contents:**
1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

**NOTE:**
- Student / s in individual or in a group should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

## Semester wise from 3rd to 6th semester
## Course Name: DISTRIBUTION OF ACTIVITIES

| Semester | Topics / Activities to be Covered |
|---|---|
| 3rd Sem. | 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.<br>2. Waste management– Public, Private and Govt organization, 5 R's.<br>3. Setting of the information imparting club for women leading to contribution in social and economic issues. |
| 4th Sem. | 4. Water conservation techniques – Role of different stakeholders– Implementation.5<br>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.<br>6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. |
| 5th Sem. | 7. Developing Sustainable Water management system for rural areas and implementation approaches.<br>8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,<br>9. Spreading public awareness under rural outreach programs.(minimum5 programs).<br>10. Social connect and responsibilities. |
| 6th Sem. | 11. Plantation and adoption of plants. Know your plants.<br>12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).<br>13. Govt. school Rejuvenation and helping them to achieve good infrastructure. |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.**

| SN | Topic | Group size | Location | Activity execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers Land / Villages / Roadside / Community Area / College Campus Etc., | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 2. | Waste management– Public, Private and Govt. organization, 5 R's. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., , | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 3. | Setting of the information imparting club for women leading to contribution in social and economic issues. | May be individual or team | Women Empowerment Groups / Consulting NGOs & Govt. Teams / College Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 4. | Water conservation techniques – Role of different stakeholders– Implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 5. | Preparing an actionable business proposal for enhancing the village income and approach for implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 6. | Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. | May be individual or team | Local Government / Private / Aided Schools / Government Schemes Officers / Etc., | School selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 7. | Developing Sustainable Water management system for rural areas and implementation approaches. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. | Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc., | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 9. | Spreading public awareness under rural outreach programs (minimum5 programs) / Social connect and responsibilities. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 10. | Plantation and adoption of plants. Know your plants. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 11. | Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs). | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 12. | Govt. school Rejuvenation and helping them to achieve good infrastructure. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government/ Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

## Plan of Action (Execution of Activities for Each Semester)

| SN | Practice Session Description |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems / issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.
CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**SUGGESTED LEARNING RESOURCES:**
**Books:**
**NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
Government of Karnataka, NSS cell, activities reports and its manual.
Government of India, NSS cell, Activities reports and its manual.

## Semester: III

## Course Name: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I

| | | | |
|---|---|---|---|
| Course Code | **22PE39** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional / state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

**Module I: Orientation** **05 Hours**

a. Lifestyle
b. Fitness
c. Food & Nutrition
d. Health & Wellness
e. Pre-Fitness test.

**Module II: General Fitness & Components of Fitness** **15 Hours**

a. Warming up (Free Hand exercises)
b. Strength – Push-up / Pull-ups
c. Speed – 30 Mtr Dash
d. Agility – Shuttle Run
e. Flexibility – Sit and Reach
f. Cardiovascular Endurance – Harvard step Test

**Module III: Recreational Activities** **10 Hours**

a. Postural deformities.
b. Stress management.
c. Aerobics.
d. Traditional Games.

## Semester III
## YOGA FOR A BETTER LIFE (3rd to 6th)

| | | | |
|---|---|---|---|
| Course Code | **22YO39** | CIE Marks | 100 / Sem. |
| Teaching Hours / Week (L:T:P) | **0:0:2** | SEE Marks | --- |
| Total Hours of Pedagogy per semester | **24 - 28 hours (Theory + practical)** | Total Marks | 100 / Sem. |
| Examination nature (SEE): | **Objective type Theory / Practical / Viva-Voce** | | |

**Course objectives:**
1. To enable the student to have good health.
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.
5. To attain higher level of consciousness.

**The Health Benefits of Yoga**

The benefits of various yoga techniques have been supposed to improve
- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as
- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:
- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system
- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

**Semester III**

## Course Name: YOGA SYLLABUS

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health

Rules to be followed during yogic practices by practitioner Yoga its misconceptions,
**Difference between yogic and non-yogic practices**
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**

a. Sitting: 1. Padmasana, 2. Vajrasana
b. Standing: 1. Vrikshana, 2. Trikonasana
c. Prone line: 1. Bhujangasana, 2. Shalabhasana
d. Supine line: 1. Utthitadvipadasana, 2. Ardhahalasana

**Semester IV**

Patanjali's Ashtanga Yoga, its need and importance.
Yama: Ahimsa, Satya, Asteya, Brahmacarya, Aparigraha
Niyama: Shoucha, Santosh, Tapa, Svaadhyaya, Eshvarapranidhan, Suryanamaskar12 Count- 4 Rounds of Practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**

a. Sitting: 1. Sukhasana, 2. Paschimottanasana
b. Standing: 1. Ardhakati Chakrasana, 2. Parshva Chakrasana
c. Prone line: 1. Dhanurasana,
d. Supine line: 1. Halasana, 2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes / min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama: 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana, 4. Chandra Bhedana 5. Nadishodhana

# Scheme of Teaching and Evaluation for

# B.E - IV Semester

# CSE (ARTIFICIAL INTELLIGENCE)

## (2022 Scheme)

## Semester: IV
## Course Name: BIOLOGY FOR ENGINEERS

| | | | |
|---|---|---|---|
| Course Code | **22BB41** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P: S) | **3:0:0:** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **3** |
| Examination type (SEE) | **Theory** | | |

**Course objectives:**

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning / inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical / hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR / VR / MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical / hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) / oral presentations.

**Module-1** **08 Hours**

**INTRODUCTION TO BIOLOGY:**

The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

**Module-2** **08 Hours**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):**

Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents / detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

**Module-3** **08 Hours**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):**

Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

**Module-4** **08 Hours**

**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):**
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

**Module-5** **08 Hours**

**TRENDS IN BIOENGINEERING (QUALITATIVE):**
Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

**Course outcome (Course Skill Set)**
At the end of the course, the student will be able to :
1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

**Suggested Learning Resources:**
**Books**
- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

**Web links and Video Lectures (e-Resources):**
- https: / / nptel.ac.in / courses / 121106008
- https: / / freevideolectures.com / course / 4877 / nptel-biology-engineers-other-non-biologists
- https: / / ocw.mit.edu / courses / 20-020-introduction-to-biological-engineering-design-spring-2009
- https: / / ocw.mit.edu / courses / 20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https: / / www.coursera.org / courses?query=biology
- https: / / onlinecourses.nptel.ac.in / noc19_ge31 / preview
- https: / / www.classcentral.com / subject / biology
- https: / / www.futurelearn.com / courses / biology-basic-concepts

**Activity Based Learning (Suggested Activities in Class) / Practical Based learning**
- Group Discussion of Case studies
- Model Making and seminar / poster presentations
- Design of novel device / equipment like Cellulose-based water filters, Filtration system

## Semester: IV
## Course Name: PRINCIPLES OF ARTIFICIAL INTELLIGENCE

| | | | |
|---|---|---|---|
| Course Code | **22CA42** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Credits | **04** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |

**Pre-requisites:**
- Knowledge of a programming language and Mathematical knowledge.

**Course objectives:**
1. Gain a historical perspective of AI and its foundations
2. Become familiar with basic principles of AI toward problem solving
3. Get to know approaches of inference, perception, Uncertain Knowledge and Reasoning.
4. Experience AI development tools such as an 'AI language', expert system shell, and / or data mining tool.
5. Experiment with a machine learning model for simulation and analysis.

**Module – 1** **8 Hours**

**Introduction:** What is AI? Foundations and History of AI
**Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

**Module - 2** **8 Hours**

**Problem-solving:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

**Module – 3** **8 Hours**

**Informed Search Strategies:** Heuristic functions, Greedy best first search, A*search. Heuristic Functions
**Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

**Module – 4** **8 Hours**

**First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.
**Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution

**Module – 5** **8 Hours**

**Uncertain Knowledge and Reasoning:** Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited

**List of Experiments:**

**Part A**

Practicing Problems in Python (Students can be encouraged to practice good number of practice problems, some practice problems are listed here)

1. a) Write a python program to print the multiplication table for the given number
   b) Write a python program to check whether the given number is prime or not?
   c) Write a python program to find factorial of the given number?
2. a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)
   b) Write a python program to implement List methods (Add, Append, and Extend& Delete).
3. Write a python program to implement simple Chabot with minimum 10 conversations
4. Write a python program to Illustrate Different Set Operations
5. a) Write a python program to implement a function that counts the number of times a string (s1) occurs in another string(s2)
   b) Write a program to illustrate Dictionary operations ([], in, traversal)and methods: keys (),values(),items()

**Part B**

**AI Problems to be implemented in Python**

1. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2. Implement and Demonstrate Best First Search Algorithm on any AI problem
3. Implement AO* Search algorithm.
4. Solve 8-Queens Problem with suitable assumptions
5. Implementation of TSP using heuristic approach
6. Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining
7. Implement resolution principle on FOPL related problems
8. Implement any Game and demonstrate the Game playing strategies

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
2. Analyse Searching and Inferencing Techniques.
3. Develop knowledge base sentences using propositional logic and first order logic
4. Demonstrating agents, searching and inferencing
5. Illustrate the application of probability in uncertain reasoning

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence | Stuart J. Russell and Peter Norvig | Pearson | 3rd Edition,2015 |
| Reference Books | | | | |
| 1 | Introduction to Machine Learning | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3RD Edition 2013 |
| 2 | Artificial Intelligence Structure and strategies for complex | George F Lugar | Pearson Education | 5th Edition 2011 |

## Semester: IV
## Course Name: DATABASE MANAGEMENT SYSTEMS

| | | | |
|---|---|---|---|
| Course Code | **22CA43** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS approach, History of database applications. When Not to Use a DBMS.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment, Centralized and Client / Server Architectures for DBMSs, Classification of Database Management Systems, Oracle and MySQL database architecture.

**Module - 2** **08 Hours**

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER Diagrams, Naming Conventions, and Design Issues, Example of Other Notation: UML Class Diagrams
**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping
**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

**Module – 3** **08 Hours**

**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database. No SQL and difference between SQL and NOSQL.
**Advanced Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.
**Advanced Aggregation Features:** Ranking – dense rank, partition by.

**Module – 4** **08 Hours**

**SQL Programming Techniques:** Overview of Database Programming Techniques and Issues, Embedded SQL, Dynamic SQL, and SQLJ, JDBC: SQL Class Library for Java Programming, Database Stored Procedures.
**Normalization:** Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

**Module – 5** **08 Hours**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Transaction support in SQL.
**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

**PRACTICAL COMPONENT** **20 Hours**

**List of Experiments**

| | |
|---|---|
| 1 | Draw an E-R diagram and map it to relation table for a given scenario. (Order Database, Cricket Database, Movie Database, College Database, Voter Database, etc.) |
| 2 | Normalize the tables. |
| 3 | Perform the following:<br>Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting / Updating / Deleting Records in a Table, Saving (Commit) and Undoing (rollback) |
| 4 | Perform the following:<br>Altering a Table, Dropping / Truncating / Renaming Tables, Backing up / Restoring a Database. |
| 5 | For a given set of relation schemes, create tables and perform the following<br>i. Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions<br>ii. Join Queries- Inner Join, Outer Join<br>iii. Subqueries- With IN clause, With EXISTS and NOT EXISTS clause |
| 6 | For a given set of relation tables perform the following<br>Creating Views (with and without check option), Dropping views, Selecting from a view |
| 7 | Demonstrate the core concepts on table like procedure and trigger queries and also rank() function. |

**Reference:**
https://www.youtube.com/watch?v=AA-KL1jbMeY https://www.youtube.com/watch?v=7S_tz1z_5bA
https://www.youtube.com/watch?v=lBpSMeQjNqQ
https://www.youtube.com/watch?v=_yog7h4BokQ https://www.youtube.com/watch?v=hSiCUNVKJAo
https://www.youtube.com/watch?v=IqQhPlJP64k https://www.youtube.com/watch?v=horURQewW9c
https://www.youtube.com/watch?v=P7-wKbKrAhk https://www.youtube.com/watch?v=MSbzErdcb6g
https://www.youtube.com/watch?v=QFj-hZi8MKk

**Course Outcomes:**
1. Demonstrate the basic elements of a relational database management system.
2. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
3. Create, populate and manage relational databases in SQL.
4. Extend normalization for the development of application software.
5. Analyze and implement transaction processing, concurrency control, and database recovery protocols in database.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry. F. Korth and S. Sudarshan | Tata McGraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

**E-Resources:**

https: / / www.youtube.com / watch?v=wOD02sezmX8
https: / / www.youtube.com / watch?v=hlGoQC332VM
https: / / www.youtube.com / watch?v=NNpFHQl_GT0
https: / / www.youtube.com / watch?v=EGEwkad_llA
https: / / www.youtube.com / watch?v=t5hsV9lC1rU

## Semester: IV
## Course Name: ANALYSIS AND DESIGN OF ALGORITHMS

| | | | |
|---|---|---|---|
| Course Code | **22CA44** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **03** |

**Course Objectives**
1. Describe basic concepts, notations, methods used in design and analysis of algorithms
2. Explain various algorithm design techniques.
3. Design and analyze the efficiency of a given problem using various design techniques.
4. Differentiate efficiency of different algorithm design techniques for a given problem.
5. Apply the suitable algorithm design technique for a given problem.

**Module – 1** **08 Hours**

**Introduction:** Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithm, Mathematical Analysis of Recursive Algorithms.

**Module - 2** **08 Hours**

**Brute Force and Exhaustive Search:** Selection Sort and Bubble Sort, Exhaustive Search. Decrease-and-Conquer: Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decrease by- a-Constant-Factor Algorithms: Binary Search, Variable- Size-Decrease Algorithm: Euclids Algorithm

**Module – 3** **08 Hours**

**Divide-and-Conquer:** Recurrence equation for divide and conquer, Master Theorem, Finding the maximum and minimum, Mergesort, Quicksort, Binary Search, Strassen's Matrix Multiplication. Transform-and-Conquer: Presorting, Heaps and Heapsort, Problem Reduction Computing the Least Common Multiple.

**Module – 4** **08 Hours**

**Greedy Method:** General method, Knapsack Problem, Job sequencing with deadlines, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm
**Dynamic Programming:** The Knapsack Problem, Warshall's and Floyd's Algorithms. Bellman- Ford Algorithm, Travelling Sales Person problem.

**Module – 5** **08 Hours**

**Backtracking:** *n*-Queens Problem, Subset-Sum Problem, Graph coloring, Hamiltonian cycles. Branch-and-Bound: Knapsack Problem, Traveling Salesman Problem, Job Assignment Problem. NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP- Complete, and NP-Hard classes.

**Course Outcomes:**
1. Apply the basic knowledge of mathematical fundamentals for finding time complexity of recursive and non-recursive algorithms.
2. Describe various algorithm design techniques to solve a given problem.
3. Apply various design techniques to find the time complexity of a given problem
4. Compare efficiency of different algorithm design techniques for a given problem
5. Choose the appropriate algorithm design techniques for a given problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to the Design and Analysis of Algorithms | Anany Levitin | Pearson | $2^{nd}$ Edition, 2009 |
| 2 | Computer Algorithms / C++ | Ellis Horowitz, Satraj Sahni and Rajasekaran | Universities Press | $2^{nd}$ Edition, 2014 |
| Reference Books | | | | |
| 1 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein | PHI | $3^{rd}$ Edition, 2009 |
| 2 | Design and Analysis of Algorithms | S. Sridhar | Oxford, Higher Education | 2014 |

## Semester: IV
## Course Name: ALGORITHMS LAB

| | | | |
|---|---|---|---|
| Course Code | **22CAL45** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Course Objectives:**
1. Demonstrate the basics concepts of Java Programming.
2. Illustrate Different Sorting Algorithm design techniques.
3. Solve Graph Applications using various design techniques.
4. Interpret combinatorial problems using Backtracking technique.
5. Develop skills to identify suitable algorithm design technique to solve a given problem

**List of Experiments:**

Identify the functional requirements, then Design and Develop solutions to the problems related to the following Algorithm design techniques

1. Brute Force technique
2. Decrease-and-Conquer method
3. Divide-and-Conquer technique
4. Transform-and-Conquer technique
5. Greedy Method
6. Dynamic Programming
7. Backtracking

**Course outcomes:**
- Design programs to implement basic concepts of java programs.
- Apply various algorithm design techniques to solve sorting problems.
- Implement graph Applications using various design techniques.
- Execute programs on combinatorial problems using Backtracking technique.
- Choose appropriate design technique to solve a given problem

**Semester: IV**
**Course Name: SYSTEM SOFTWARE**

| | | | |
|---|---|---|---|
| Course Code | **22CA461** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
1. Basic Computer organization and architecture
2. Basic concepts of Operating System
3. Good programming skills in C and data structures

**Course objectives**
1. Distinguish between system software and application software
2. Categorize the instruction formats and addressing modes of SIC and SIC / XE machine.
3. Write the object code for SIC and SIC / XE machine programs
4. List the steps involved to design a Bootstrap loader
5. Apply regular expressions to develop programs using LEX and YACC tools.

**Module – 1** **08 Hours**

**Machine Architecture:** Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC / XE Machine Architecture, SIC Programming Examples. Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

**Module – 2** **08 Hours**

**Assemblers-2:** Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations – 1 Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.

**Module – 3** **08 Hours**

**Loaders and Linkers:** Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

**Module – 4** **08 Hours**

**Macro Processor:** Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

**Module – 5** **08 Hours**

**Lex and Yacc -** The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running 43 LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.
Using YACC – Grammars, Recursive Rules, Shift / Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.

**Course outcomes:**

1. Design programs to implement basic concepts of java programs.
2. Apply various algorithm design techniques to solve sorting problems.
3. Implement graph Applications using various design techniques.
4. Execute programs on combinatorial problems using Backtracking technique.
5. Choose appropriate design technique to solve a given problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | System Software | Leland L. Beck D Manjula | Pearson Education | 3rd Ed, 2012 |
| 2 | Lex and Yacc | John R. Levine,<br>Tony Mason and Doug Brown | O'Reilly | 2012 |
| **Reference Books** | | | | |
| 1 | System Programming and Operating Systems | D.M. Dhamdhere, | Tata McGraw - Hill | 3rd Ed, 2013. |
| 2 | Systems programming | Srimanta Pal | Oxford university press | 2016 |

## Semester: IV
## Course Name: OBJECT ORIENTED PROGRAMMING WITH PYTHON

| | | | |
|---|---|---|---|
| Course Code | **22CA462** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **3** |

**Pre-requisites:**
- Basic Knowledge of Programming
- Basic Knowledge of MS word, Excel and PDF

**Course objectives**
1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples and dictionaries.
3. Demonstrate the use of built-in functions of file system.
4. Implement the Object Oriented Programming concepts in Python.
5. Appraise the need for working with various documents like Excel, PDF, Word and Others.

**Module – 1** **08 Hours**

**Python Basics,** Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Module - 2** **08 Hours**

**Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings**, Working with Strings, Useful String Methods

**Module – 3** **08 Hours**

**Reading and Writing Files**, Files and File Paths, The os path Module, The File Reading / Writing Process, Saving Variables with the shelve Module, Saving Variables withthe pprint. pformat() Function, Project: Generating Random Quiz Files, Project: Multi clipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, **Debugging**, Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

**Module – 4** **08 Hours**

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions**, Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods**, Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The_str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance**, Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Module – 5** **08 Hours**

| |
|---|
| **Working with Excel Spreadsheets**, Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF** and Word Documents, PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV** files and JSON data, The csv Module |

**Course Outcomes:**

1. Demonstrate proficiency in handling of loops and creation of functions.
2. Identify the methods to create and manipulate lists, tuples and dictionaries.
3. Utilize built-in functions to navigate the file system.
4. Apply the concepts of Object-Oriented Programming to different applications
5. Develop proficiency in working with Excel spreadsheets, PDF and Word documents, CSV files, and JSON data

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist", | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press / Taylor & Francis | 1st Edition,2018 |

**e-Resources:**

https://automatetheboringstuff.com
http://greenteapress.com/thinkpython2/thinkpython2.pdf)

## Semester: IV
## Course Name: INTRODUCTION TO DATA ANALYTICS

| | | | |
|---|---|---|---|
| Course Code | **22CA463** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

**Introduction,** Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module – 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms. Advanced data visualization- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map / hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools and Practices | Dr.Gaurav Aroraa Chitra Lele Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: IV**

**Course Name: PROFESSIONAL SKILLS FOR THE WORK PLACE**

| | | | |
|---|---|---|---|
| Course Code | **22PSW47** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **30** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
1. Basic Conversational English
2. Fundamentals of Mathematics
3. Basic Knowledge of Reasoning

**Module – 1** **06 Hours**

**Communication Skills**
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

**Module – 2** **06 Hours**

**Presentation Skills**
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

**Module – 3** **06 Hours**

**Verbal & Numerical Ability**
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

**Module – 4** **06 Hours**

**English Language**
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors.

**Module – 5** **06 Hours**

**Verbal Ability and Verbal Reasoning**
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

**Course Outcomes:**
1. Demonstrate communicative ability in a professional environment
2. Articulate one's ideas and demonstrate them to an audience
3. Transform one's English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Reasoning N' Reasoning - Verbal & Non-verbal Reasoning | Dr. Ravi Chopra | Galgotia | 1994 |
| 2 | Magical Book on Quicker Math | M. Tyra | BSC | I Edition, 2018 |
| 3 | Communicate With Confidence | Diana Booher | Mc-Graw-Hill | Nov 2011 |
| **Reference Books** | | | | |
| 1 | Cambridge Advanced Learner's Dictionary | Cambridge University Press | CBS | IV Edition, 2013 |
| 2 | A Modern Approach to Verbal and Non-verbal Reasoning | R S Agarwal | S Chand | II Edition, 2018 |
| 3 | Word Power Made Easy | Norman Lewis | Goyal Publishers | IV Edition, 2014 |
| 4 | Speak With Confidence | Diana Booher | Mc-Graw-Hill | I Edition, 2002 |

## Semester: IV
## Course Name: UNIVERSAL HUMAN VALUES (UHV)

| | | | |
|---|---|---|---|
| Course Code | **22UH48** | CIE Marks | **50** |
| Teaching Hours / Week (L: T:P: S) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15 hour Theory Session +15 hour Self study** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01 Hour** |
| Examination type (SEE) | **SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions).** | | |

**Course objectives:**
This course is intended to:
1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evaluation.
7. Encourage the students for group work to improve their creative and analytical skills.

**Module-1** **03 hours**

**Introduction to Value Education:**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

**Module-2** **03 hours**

**Harmony in the Human Being :**
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

**Module-3** **03 hours**

| **Harmony in the Family and Society :** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order |
|---|

**Module-4** **03 hours**

| **Harmony in the Nature / Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence |
|---|

**Module-5** **03 hours**

| **Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession |
|---|

**Course Outcome (Course Skill Set)**

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**Expected to positively impact common graduate attributes like:**

- Ethical human conduct
- Socially responsible behaviour
- Holistic vision of life
- Environmentally responsible work
- Having Competence and Capabilities for Maintaining Health and Hygiene

**Semester: IV**

**Course Name: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II**

| | | | |
|---|---|---|---|
| Course Code | **22PE49** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organization and administration of sports and games.

**Module IV: Ethics and Moral Values** **5 Hours**

Ethics in Sports
Moral Values in Sports and Games

**Module V: Specific Games (Any one to be selected by the student)** **20 Hours**

Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
Throw ball – Service, Receive, Spin attack, Net Drop & Jump throw.
Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.
Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.
Athletics (Track / Field Events) – Any event as per availability of Ground.

**Module VI: Role of Organization and Administration** **05 Hours**

**Semester: III**
**Course Name: ADDITIONAL MATHEMATICS-I**
**(For Lateral Entry Students)**

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP31** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **00** | Exam Hours | **-** |

**Pre-requisites:**
1. Algebraic formulae
2. Differentiation
3. Integration
4. Trigonometric formulae

**Module – 1** **08 Hours**

**Linear Algebra**
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
**Self-Study:** Gauss Jordon Method

**Module - 2** **08 Hours**

**Differential Calculus:**
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
**Self-Study:** Taylor's series expansion.

**Module – 3** **08 Hours**

**Vector Differentiation:**
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields-Problems.
**Self-Study:** Angle between two surfaces[RBT Levels: L1, L2,L3]

**Module – 4** **08 Hours**

**Integral Calculus:**
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\, Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
**Self-Study:** Change of Order of Integration.

**Module – 5** **08 Hours**

**Ordinary Differential Equations:**
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli's equation.
**Self-Study:** Homogeneous differential equations

**Course outcomes:**

1. Upon Completion of this course, student will be able to,
2. Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.
3. Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
4. Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
5. Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
6. Solve first order linear differential equations analytically using standard methods.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43rd Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | John Willy & Sons | 10th Ed. (Reprint). 2016 |
| 3 | Additional Mathematics-1 | Dr. Pandurangappa | Sanguine Technical Publishers | 4th Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V. Ramana | Tata McGraw-Hill | 11th Edition.2010 |

**Semester: IV**
## Course Name: ADDITIONAL MATHEMATICS-II
**(For Lateral Entry Students)**

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP41** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **0** | Exam Hours | **-** |

**Pre-requisites:**
1. Differentiation
2. Integration
3. Trigonometric formulae
4. Differential equations

**Module – 1** **08 Hours**

**Higher Order ODE's**
Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous / non-homogeneous equations. Inverse differential operators.[Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$
**Self-Study:** Finding particular Integral for $\phi(x) = x^m$

**Module – 2** **08 Hours**

**Partial Differential Equations (PDE's):**
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDE involving derivative with respect to one independent variable only.
**Self-Study:** Method of separation of variables

**Module – 3** **08 Hours**

**Laplace Transform:**
Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t), t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.
Inverse Laplace Transform: Definition, Inverse Laplace Transform of standard functions. Inverse transform by Partial Fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.
**Self-Study:** Convolution Theorem.

**Module – 4** **08 Hours**

**Numerical Methods:**
Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.
Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula without proof problems.
**Numerical Integration:** Simpson's 1 / 3$^{rd}$ and 3 / 8$^{th}$ rule (without proof) - problems.
**Self-Study:** Weddle's Rule

**Module – 5** **08 Hours**

**Probability:**
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem. Problems.
**Self-Study:** Applications of Bayes' theorem

**Course outcomes:**
1. Upon completion of this course, student will be able to,
2. Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
3. Construct a variety of partial differential equations and solution by various methods.
4. Use Laplace Transform and inverse Laplace Transform in solving differential / integral equation arising in network analysis, control systems and other fields of engineering
5. Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
6. Use the concepts of probability in different probability distribution.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43rd Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | Jhon willy & Sons | 10th Ed. (Reprint) 2016 |
| 3 | Additional Mathematics-2 | Dr. Pandurangappa | Sanguine Technical Publishers | 4Th Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V.Ramana | Tata McGraw-Hill | 11th Edition.2010 |

**SUGGESTED TEACHING LEARNING PROCESS**

**The faculty members are suggested to use appropriately the following Teaching Learning methods:**
1. Active Learning
2. Chalk and Board for Numerical
3. Demonstration using simulator
4. Laboratory Demonstrations
5. Power Point Presentations
6. Problem based learning
7. Video Lecturers

*** *** ****

## Assessment Details

**1. Integrated professional Core Courses (IPCC):**
**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| X | Total Marks for theory component A+B | | | 30 |

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| Y | Total Marks | | 20 |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***
**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04 / 05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**2. Professional Core / Basic Science / ESC / ETC / PLC courses (Theory):**
**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B) = 30 + 20 = 50**
**Semester End Examination (SEE)**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE.
- Marks secured will be scaled down to 50.

**3. Professional Core Course (PCC) Lab / Ability Enhancement course (Lab):**

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. Marks distribution: Procedure (15%) + Execution (70%) + Viva Voce (15%)

**4. Ability Enhancement Course (AEC) / Skill Enhancement course (SEC) (Theory) , Universal human values Course (22UH48):**

**Assessment Details of CIE**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

**SEE Guidelines for the Courses**

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

**Suggested Alternate Assessment Tools for PCC, IPCC and AEC Courses:**

1. Quiz
2. Assignments
3. Seminars / Presentations
4. Paper Publications
5. Mini Projects
6. MOOCs
7. Industrial Visits and Report Writing
8. Self-learning with Certifications and
9. Cooperative and problem based learning.

**No SEE for the Courses: Social Connect and Responsibility (22SC37), NSS, YOGA, Sports and Athletics.**

# Scheme of Teaching and Evaluation for

# B.E – III & IV Semester

# CSE (DATA SCIENCE)

## (2022 Scheme)

# B.E. in Computer Science (Data Science)
## Scheme of Teaching and Examinations - 2022
## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
## (Effective from the academic year 2023-24)

## III SEMESTER

| SN | Course | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | SDA (S) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BSC | 22MDA31 | Graph theory and Discrete Mathematical Structures, Probability and Statistics | TD: Maths, PSB: Maths | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CD32 | Digital System Design and Computer Organization | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CD33 | Operating System | TD & PSB: CSE /AIML /CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CD34 | Data Structures and Applications | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CDL35 | Data Structures Lab | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CD36 | ESC/ETC/PLC Object Oriented Programming With JAVA | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22SC37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC/ SEC | 22CD38X | Ability Enhancement Course / Skill Enhancement Course - III | TD & PSB: CSE /AIML / CS[AI], CS[DS] | If the course is a Theory: 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | | | | | If the course is a Laboratory: 0 | 0 | 2 | | 02 | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| **Total** | | | | | | | | | | **550** | **350** | **900** | **20** |

| Ability Enhancement Course – III | | | |
|---|---|---|---|
| 22CD381 | Unix and Shell Programming | 22CD382 | Version Controller with GiT |
| 22CD383 | R Programming | | |

## ADDITIONAL MATHEMATICS for Lateral Entry Students

| SN | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | Self -Study (S) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **22MATDIP31** | **ADDITIONAL MATHEMATICS-I** | **MATHS** | **3** | **0** | **0** | | **03** | **100** | **00** | **100** | **0** |

## B.E. in Computer Science (Data Science)
## Scheme of Teaching and Examinations - 2022
## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
## (Effective from the academic year 2023-24)

## IV SEMESTER

| SN | Course and Course Code | | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self-Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22BB41 | Biology for Engineers | TD & PSB: | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CD42 | Introduction to Data Science | TD & PSB: CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CD43 | Database Management Systems | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CD44 | Analysis and Design of Algorithms | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CDL45 | Algorithms Lab | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CD46X | ESC/ETC/PLC | TD & PSB: CSE /AIML / CS[AI], CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | AEC/ SEC | 22PSW47 | Professional Skills for the Work Place | TD & PSB: H&S | If the course is a Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If the course is a Laboratory | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 8 | UHV | 22UH48 | Universal human values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | 22NS49 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE49 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Yoga | Yoga Teacher | | | | | | | | | |
| Total | | | | | | | | | | 500 | 400 | 900 | 20 |

### Engineering Science Course (ESC/ETC/PLC)

| | | | |
|---|---|---|---|
| 22CD461 | System Software | 22CD462 | Object Oriented Programming with Python |
| 22CD463 | Introduction to Data Analytics | | |

### ADDITIONAL MATHEMATICS for Lateral Entry Students

| SN | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self -Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | L | T | P | S | | | | | |
| 1 | 22MATDIP41 | ADDITIONAL MATHEMATICS-II | MATHS | 3 | 0 | 0 | | 03 | 100 | 00 | 100 | 0 |

# Scheme of Teaching and Evaluation for

# B.E – III Semester

# CSE (DATA SCIENCE)

# (2022 Scheme)

## Semester: III

## (COMMON TO AIML & CS (AI) & CS (DA))

## Course Name: **Graph theory and Discrete Mathematical Structures, Probability and Statistics**

| | | | |
|---|---|---|---|
| Course Code | **22MDA31** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | 50 |
| Total Hours of Pedagogy | **3:0:0** | Total Marks | 100 |
| Credits | **03** | Exam Hours | 03 |

**Pre-requisites:**
1. Definition of set, operations on sets and Definitions of different types of functions
2. First order Ordinary Differential Equations.
3. Statistics and probability

**Course objectives:**
1. Understand and explain the basic concepts of graph theory.
2. Understand an intense foundational introduction to fundamental concepts in discrete Mathematics.
3. Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Applying discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
6. Construct joint probability distributions.

**Module – 1** **08 Hours**

**Introduction to Graph Theory**
Definitions of degree, graph, incidence, Sub graphs, connected graphs, complete graph, Complement of a graph, and Graph Homorphism and Isomorphism. Bipartite graphs, Walks, paths and cycles. Hamiltonian and Euler Circuits.Planar graphs, Euler’s formula (With Proof), Dual of a planar graph.
**Self-Study:** The Konigsberg bridge problem.
**Applications:** Internet filed. Google maps, webpage searching.

**Module – 2** **08 Hours**

**Relations and Functions:**
Definition of a relation, Matrix of a relation, Diagraph of a relation. Properties of relation. Equivalence relation (Theorems on Equivalence Relations). Partial ordered relation and poset. Least upper bound and greatest lower bound. Hasse diagram.
Compositions of functions, (Theorems on Composition functions). The pigeon hole principle., Permutation functions.
**Self-Study;** Invertible functions.
**Applications;** computer programme and coding.

**Module – 3** **08 Hours**

**Recurrence Relations;**
Definitions of a Recurrence relation. First Order Linear Recurrence Relation, and its applications The Second Order Linear Homogeneous Recurrence Relation, Non-homogeneous Recurrence Relation,
**Self-Study:** Generating Functions.
**Applications: A**To express the runtime complexity of an algorithm in a concise and mathematical form.

**Module – 4** **08 Hours**

**Statistical Methods and Curve Fitting:**
Correlation and regression- Karl Pearson's coefficient of correlation and rank correlation, problems, lines of regression, problems.
Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b, y = ax^b \; and \; y = ax^2 + bx + c$.
**Self-Study;** To fit the curve $y = ab^x, y = ae^{bx}$.
**Applications:** Data visualization, data analysis and data mining.

**Module – 5** **08 Hours**

**Probability Distribution;**
Review of Probability theory, Random variables (discrete and continuous), and Binomial and Poisson distribution their mean and variance (with proofs), Normal distribution (without proof).
Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.
**Self-Study;** Exponential distribution.
**Applications:** Network traffic modeling.

**Course Outcomes:**

**CO1**: Know some important classes of graph theoretic problems.
**CO2:** Analyze the concepts of relations to various fields of Engineering.
**CO3:** Apply the concepts of functions and recurrence relations in the context of various fields of Computer Science Engineering, like, Database, finite Automata and formal languages, Compilers etc.
**CO4:** Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
**CO5:** Applying discrete and continuous probability distributions in analysing the probability models arising in engineering field and Construct joint probability distributions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Graph theory with applications to engineering and computer science | Narsingh Deo | Dover publishers | 1st Edition 2016 |
| 2 | Higher Engineering Mathematics, | B.S. Grewal | Khanna Publishers. | 44th Edition, 2017. |
| 3 | Advanced Engineering Mathematics | Erwin Kreyszig. | *Wiley Publications* | 10th Edition,2011 |
| 4 | Foundation of Discrete Mathematics | K D Joshi | *New* Age Publishers, Ltd | 10th Edition, 2014 |
| 5 | Discrete and Combinatorial Mathematics | Ralph P. Grimaldi | Pearson Education. Inc. | 5th Edition, 2011. |
| **Reference Books** | | | | |
| 1 | Graph theory and combinatorics | Dr. D. Chandrashekar | Prism Publisher | 12th Edition 2010. |
| 2 | Higher Engineering Mathematics | B.V Ramana | Tata McGraw-Hill | 11th Edition,2010 |
| 3 | Discrete Mathematics and its applications | Kenneth H. Rosen | Tata McGraw-Hill, | 7th Edition,2012 |
| 4 | Discrete Mathematical Structures: Theory and Applications | D. S. Malik, M. K. Sen | Thomson Course Technology. | 1st Edition, 2004 |

**e-Resources:**

1. http://nptel.ac.in/courses/111106050/13
2. https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11
3. https://www.youtube.com/watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index=13
4. https://www.youtube.com/watch?v=7cTWea9YAJE&list=PL0862D1A947252D20&index=24.
5. https://www.youtube.com/watch?v=695iAm935cY&list=PL0862D1A947252D20&index=25.
6. https://www.youtube.com/watch?v=X0sGo7X2xHw.
7. https://www.youtube.com/watch?v=7FJ08NILBuA

**Semester; III**

Course Name: **DIGITAL SYSTEM DESIGN AND COMPUTER ORGANIZATION**

| | | | |
|---|---|---|---|
| Course Code | **22CD32** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **4** | Exam Hours | **03** |

**Pre-requisites:**
- Basic Electronics
- Basic Structure of Computer.

**Course objectives**
- Illustrate different simplifying techniques in the design of combinational circuits.
- Design various combinational and sequential digital circuits.
- Design various counters using Flip-Flops.
- Demonstrate the fundamentals of computer organization with machine instructions.
- Elaborate the communication of input/output devices with computer system and solve arithmetic Operations using various techniques.

**Module – 1** **08 Hours**

**Karnaugh Maps:** minimum forms of switching functions, two and three variable Karnaugh maps, four variable Karnaugh maps, determination of minimum expressions using essential prime implicants, Quine- McCuskey Method: determination of prime implicants, the prime implicant chart, simplification using map-entered variables

**Module – 2** **08 Hours**

**Multiplexers, Decoders and Programmable Logic Devices:** Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.
**Latches and Flip-Flops:** Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop, SR Flip Flop, J K Flip Flop, T Flip Flop.

**Module – 3** **08 Hours**

**Register and Counters:** Register and register transfers, Shift registers
**Counters:** design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops. Sequential parity checker

**Module – 4** **08 Hours**

**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance– Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes

**Module – 5** **08 Hours**

**Input/output Organization:** Accessing I/O Devices, Interrupts, Direct Memory Access, Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth algorithm.

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | a) Realize 3-Variable and 4-variable Boolean expressions, simplify it using K-map and Implement using basic gates.<br>b) Simulate and verify the working of above expressions using VHDL |
| 2 | a) Design and implement Half adder and Full Adder using basic gates.<br>b) Simulate and verify the working of Half adder and Full Adder using VHDL |
| 3 | a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer.<br>b) Simulate and verify the working of 8:1 multiplexer using VHDL |
| 4 | Design and implement the Binary to Gray Code converter using basic gates.<br>Simulate and verify the working of Binary to Gray Code converter using VHDL |
| 5 | a) Design and implement the Truth Table of a 3-bit Parity Generator and 4-bit Parity<br>b) Checker with an even parity bit using basic Gates. |
| 6 | a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.<br>b) Simulate and verify the working of D Flip-Flop with positive edge triggering using VHDL. |
| 7 | a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-flop ICs<br>b) Simulate and verify the working of mod-8 up counter using VHDL. |
| 8 | a) Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC7447).<br>b) Simulate and verify the working of Switched tail counter using VHDL |

**Course Outcomes:**

1. Apply different simplifying techniques in the design of combinational circuits.
2. Design various combinational and sequential digital circuits.
3. Design various counters using Flip-Flops.
4. Describe the fundamentals of computer organization with machine instructions.
5. Elaborate the communication of input/output devices with computer system and solve arithmetic Operations using various techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Analog and Digital Electronics | Charles H Roth and Larry L Kinney | Cengage Learning | 2019 |
| 2 | Computer Organization | Carl Hamacher, Zvonko Vranesic, Safwat Zaky | Tata McGraw Hill | $5^{th}$ Edition 2002 |
| | **Reference Books** | | | |
| 1 | Digital Principles and Applications, | Donald P Leach, Albert Paul Malvino & Goutam Saha | Tata McGraw Hill, | $8^{th}$ Edition 2015 |
| 2 | Computer Organization & Architecture, Pearson | William Stallings | | $9^{th}$ Edition |

**e-Resources: 1. http://lms.vtu.ac.in/econtent/CSE.php**

## Semester: III
## Course Name: OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **22CD33** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Exam Hours | **3** |
| Credits | **4** | Total Marks | **100** |

**Pre-requisites:**
The students should have the knowledge of:
1. Basics of computer system and its applications
2. Basics of computer organization

**Course objectives**
1. To introduce operating system, OS responsibilities, and OS services.
2. To discuss process concept, process scheduling techniques, and multi-threading concepts.
3. To demonstrate deadlock condition in the computer system, and usage of main memory.
4. To introduce virtual memory management concepts and file system.
5. To explain about secondary storage system and Linux OS as a case study.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems;
**Operating System Services**: User - Operating system interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating system structure; Virtual machines; System boot.

**Module - 2** **08 Hours**

**Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication.
**Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple- processor scheduling; thread scheduling.
**Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; threading issues.

**Module – 3** **08 Hours**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.
**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

**Module – 4** **08 Hours**

**Virtual Memory Management**: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.
**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Module – 5** **08 Hours**

| |
|---|
| **Secondary Storage Structures, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. **Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter- process communication. |

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Install an operating system on a physical or logical (virtual) machine. |
| 2 | Design, develop and implement program to simulate the working of Shortest Remaining Time First scheduling algorithm. Experiment with different length jobs. |
| 3 | Design, develop and implement program to simulate the working of Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm. |
| 4 | Design, develop and implement a Banker's algorithm. Assume suitable input required to demonstrate the results. |
| 5 | Design, develop and implement page replacement using FIFO algorithms. Assume suitable input required to demonstrate the results. |
| 6 | Design, develop and implement page replacement using LRU algorithms. Assume suitable input required to demonstrate the results. |
| 7 | Design, develop and implement optimal page replacement algorithms. Assume suitable input required to demonstrate the results. |

**Course Outcomes:**

At the end of the course students will be able to

1. Analyze the need, responsibilities, and services of OS.
2. Compare different process scheduling techniques.
3. Examine deadlock situation, prevention, avoidance and recovery.
4. Implement virtual memory management concept and file system.
5. Demonstrate the structure of secondary storage and design of Linux OS.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition,, 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed, 2013. |
| 2 | An Introduction to Operating Systems: Concepts and Practice | P.C.P. Bhatt | PHI(EEE) | 4th Edition, 2014 |

**E-Resources:**

https://www.operating-system.org/
https://blog.feedspot.com/operating_system_blogs/
https://www.youtube.com/playlist?list=PLhqPDa2HoaAZLws7PFYWl4MnzCyHf8do-
https://medium.com/javarevisited/6-best-operating-system-courses-for-beginners-to-learn- 7d727882d267

## Semester: III
## Course Name: DATA STRUCTURES AND APPLICATIONS

| | | | |
|---|---|---|---|
| Course Code | **22CD34** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **03** |

**Course objectives:**
1. Explain the fundamentals of data structures and their applications to solve real life problems.
2. Demonstrate the working of linear and nonlinear data structures.
3. Write solutions to problems using linear data structures and nonlinear data structures.
4. Apply different data structures to solve given problem.
5. Develop skills to apply appropriate data structures in problem solving.

**Module – 1** **08 Hours**

**Review of C Language:** Arrays, Structures & Unions, Pointers and Dynamic memory allocation **Introduction to Data Structures:** Classifications of Data Structures, Data structure operations: Traversing, inserting, deleting, searching and sorting.
**Applications:** Representation of Polynomials and Sparse Matrices

**Module – 2** **08 Hours**

**Stacks:** Stack Operations, Array Representation of Stacks, Different types of expression: Infix, Postfix and Prefix.
**Stack Applications:** Infix to postfix conversion, Infix to prefix conversion, Evaluation of postfix expression, Recursion.
**Queues:** Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues.

**Module – 3** **08 Hours**

**Linked Lists:** Classification of linked lists. Representation of different types of linked lists in Memory. Traversing, Insertion, Deletion, Searching, Sorting and Concatenation Operations on Singly linked list. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues.
**Applications of Linked lists** – Polynomials, Sparse matrix representation.

**Module – 4** **08 Hours**

**Trees 1:** Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder;
**Threaded binary trees**
**Binary Search Trees:** Binary Search Trees, Insertion, Deletion, Traversal and Searching operations on Binary search tree. Application of Trees: - Evaluation of Expression.

**Module – 5** **08 Hours**

**Graphs:** Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
**Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

**Course Outcomes:**

1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | 2nd Ed, 2014 |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | 2nd Ed, 2014 |
| **Reference Books** | | | | |
| 1 | Data Structures using C | ReemaThareja | Oxford press | 3rd Ed 2012 |
| 2 | Data Structures using C | A M Tenenbaum | PHI | 2001 |

## Semester: III
## Course Name: DATA STRUCTURES LAB

| | | | |
|---|---|---|---|
| Course Code | **22CDL35** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **03** |

**List of Experiments**

**Course Objectives:**
1. Illustrate implementation of basic operations on data structures.
2. Interpret Applications of different data structures.
3. Demonstrate data structures and their variants.
4. Illustrate various searching techniques using trees and graphs.
5. Develop skills to identify appropriate data structures to solve a given problem.

**Identify the functional requirements, then Design and Develop solutions to the problems related to the data structures**
1. Stacks and Queues
2. Linked list
3. Trees
4. Graphs
5. Hashing techniques

**Course outcomes:**
1. Design programs to implement basic operations on data structures.
2. Apply different data structures to solve problems.
3. Develop programs to demonstrate variants of queues and linked list
4. Implement various Searching techniques using trees and graphs.
5. Choose appropriate data structures to solve a given problem.

## Semester: III
## Course Name: OBJECT ORIENTED PROGRAMMING WITH JAVA

| | | | |
|---|---|---|---|
| Course Code | **22CD36** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **3** |

**Pre-requisites:**
Students should know the basic knowledge on:
- C Programming
- C++

**Course objectives**
1. Learn fundamental features of object-oriented language and JAVA.
2. Learn object-oriented concepts using programming examples.
3. Study the concepts of importing packages, exception handling mechanism and multithreading.
4. Introduce event handling mechanism.
5. Create Graphical User Interface (GUI) applications using swings.

**Module – 1** **08 Hours**

**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.
**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses. **Control Statements:** Java's Selection Statements, Iteration Statements

**Module - 2** **08 Hours**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, "This" Keyword, Garbage Collection.
**A Closer Look at Methods and Classes:** Overloading Methods.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class

**Module – 3** **08 Hours**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. **Exception Handling:** Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built- in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.
**Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(),Thread Priorities.

**Module – 4** **08 Hours**

**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model; Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes.

**Module – 5** **08 Hours**

**Introducing Swings:** The Origins of Swing, Two Key Swing Features, Components and Containers, The Swing Packages; A Simple Swing Application, Create a Swing Applet.
**Exploring Swings:** J label and Image Icon, J Text Field, The Swing Buttons, J Tab bed pane, J List, J Combo Box, J Table.

**Course Outcomes:**
1. Identify classes, objects, members of a class and relationship among them needed for a specific problem.
2. Implement reusability Programs in JAVA using inheritance.
3. Develop JAVA Programs of error handling techniques using exception handling.
4. Apply the concepts of event handling to develop GUI programs.
5. Apply the concepts of Java Swings to develop robust programs.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8thEdition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balaguruswamy | Tata McGraw Hill | 3rd Edition,2007 |

**e-Resources:**
How to install java:-*https://youtu.be/IJ-PJbvJBGs*
Java Swings:-*https://youtu.be/TwMXA1S38qg*
Java Quiz:-https://www.w3schools.com/java/java_quiz.asp
Java Concepts:-https://www.javatpoint.com/java-tutorial
ProgrammingExercises:-https://www.programiz.com/java-programming/examples

## Semester: III

## Course Name: SOCIAL CONNECT & RESPONSIBILITY

| | | | |
|---|---|---|---|
| Course Code | **22SC37** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P: S) | **0:0:2** | SEE Marks | **--** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (No SEE – Only CIE) | **For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept. / Any Dept.** | | |
| Credits | **01 – Credit** | | |

**Course objectives:**

The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Contents:**

- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

**In the following a set of activities planned for the course have been listed:**

| Contents |
|---|
| **Part I:**<br>**Plantation and adoption of a tree:**<br>Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. |
| **Part II :**<br>**Heritage walk and crafts corner:**<br>Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes. |
| **Part III :**<br>**Organic farming and waste management:**<br>Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – |
| **Objectives, Visit, Case Study, Report, Outcomes.**<br>**Part IV:**<br>**Water conservation:**<br>Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes. |

**Part V :**
**Food walk:**
City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Communicate and connect to the surrounding.
CO2: Create a responsible connection with the society.
CO3: Involve in the community in general in which they work.
CO4: Notice the needs and problems of the community and involve them in problem –solving.
CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Activities:**
Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**PEDAGOGY:**
The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs / social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

**COURSE TOPICS:**
The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

**DURATION:**
A total of 40 - 50 hours engagement per semester is required for the 3rd semester of the B.E. / B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

**Guideline for Assessment Process:**
**Continuous Internal Evaluation (CIE):**
After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor / s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and / or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

**Excellent:** **80 to 100**
**Good:** **60 to 79**
**Satisfactory:** **40 to 59 Unsatisfactory and fail : <39**

**Special Note:**

**NO SEE – Semester End Exam – Completely Practical and activities based evaluation**

**Pedagogy – Guidelines:**

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

| SN | Topic | Group size | Location | Activity Execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Plantation and adoption of a tree: | May be individual or team | Farmers land / parks / Villages / roadside / community area / College campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 2. | Heritage walk and crafts corner: | May be individual or team | Temples / monumental places / Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 3. | Organic farming and waste management: | May be individual or team | Farmers land / parks / Villages visits / roadside / community area / College campus etc. | Group Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 4. | Water conservation: & conservation techniques | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 5. | Food walk: Practices in society | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Group Selection / Proper Consultation A/ Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |

**Plan of Action (Execution of Activities)**

| SN | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study based Assessment, Individual performance |
| 9 | Sector / Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities, compiled report should be submitted as per the instructions and scheme.

## Semester: III
## Course Name: UNIX AND SHELL PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **22CD381** | CIE Marks | **50** |
| Teaching Hours/Week (L: T; P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **02** |

**Pre-requisites:** *Knowledge of DOS and Windows*

**Module – 1** **03 Hours**

**Introduction**, Brief history, Unix Architecture, Features of Unix, locating commands, Command structure, Internal and External commands, man command, Understanding the man documentation, **Basic commands** such as cal, date, echo, printf, passwd, who, wc, ls.

**Module - 2** **03 Hours**

**Unix files:** Basic file types, Parent-child relationship, the home directory, PATH variable. Relative and absolute pathnames.
**Directory commands** – pwd, cd, mkdir, rmdir commands,
**File related commands** – cat, cp, rm, mv.

**Module – 3** **03 Hours**

**File Types & Permission:**
The ls -l command, -d options, File ownership, File permissions, chmod, Directory permissions, changing File ownership.
**The vi editor:** Different modes of vi, Input mode commands, Command mode commands, ex- mode commands, Repeat command, Pattern searching, Search and Replace command.

**Module – 4** **03 Hours**

**The shells interpretive cycle**: Wild cards, Escaping and Quoting, Three standard files and redirection, Pipe, tee, Command substitution.
**Shell programming:** Ordinary and environment variables, read command, Command line arguments, exit and exit status of a command, Logical operators for conditional execution, test command and its shortcut, if, expr, while, for, and case-control statements, set and shift commands, positional parameters.

**Module – 5** **03 Hours**

**Process:** Basics, Mechanism of process creation, Parent and child process, The ps command with its options, Signals, Job control.
**File Links:** Hard link and soft link, umask, head, tail, cut, paste, sort and grep commands.

**Course Outcomes:**
1. Demonstrate the architecture and salient features of UNIX OS.
2. Understand UNIX Commands, Shell basic, and shell environments.
3. Create a file with vi editor and Apply changes in the file permission and ownership.
4. Design and develop shell programs using loops, and control statements.
5. Create UNIX Processes and a simple filter.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Unix Concepts and Applications | Sumitabha Das | Tata McGraw Hill | $4^{th}$ Edition |

## Semester: III
## Course Name: VERSION CONTROLLER WITH GiT

| | | | |
|---|---|---|---|
| Course Code | **22CD382** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **2** |

**Pre-requisites:**
- Basic knowledge of computer hardware and software
- Basic knowledge of programming

**COURSE OBJECTIVES**
1. To demonstrate the installation Git, set up their initial configuration, and comprehend the advantages and disadvantages of using Git for version control.
2. To illustrate the concept of creating and managing Git repositories
3. To implement branching concepts of Git including creating, merging, and switching branches, enabling them to effectively manage parallel development efforts
4. To illustrate setting up Git on a server, allowing them to facilitate collaborative development
5. To experiment with hosting repositories on GitHub, managing project issues there, and collaborating with others.

**Module – 1** **03 Hours**

**Getting Started:** Version Control Basics, What Is Git?, Advantages Of Git, Disadvantages Of Git.
**The Basics:** Installing Git, First Time Git Set Up, Tips And Troubleshooting

**Module - 2** **03 Hours**

**Working with Repositories:** What Are Git Repositories?, Recording Changes To Repos, Working With Remotes, Git Aliases, Tagging

**Module – 3** **03 Hours**

**Working with Branches:** What Are Branches?, Branching And Merging, Branch Workflows, Remote Branches

**Module – 4** **03 Hours**

**Working with Servers:** Getting Git On Server, Server Setup, Distributed Git And Projects

**Module – 5** **03 Hours**

**GitHub:** What Is Github? History Of Github, How To Use Github, Different Types Of Accounts

**Course Outcomes:**
1. Install Git, set up their initial configuration, and comprehend the advantages and disadvantages of using Git for version control.
2. Gain proficiency in creating and managing Git repositories
3. Implement branching concepts of Git including creating, merging, and switching branches, enabling them to effectively manage parallel development efforts
4. Set up Git on a server, allowing them to facilitate collaborative development
5. Use GitHub as a platform for hosting repositories, tracking project issues, and collaborating with others

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Git: A Beginner's Guide | Sumanna Kaul, Shahryar Raz, and Divya Sachdeva | CRC Press | 2022 |
| **Reference Books** | | | | |
| 1 | Learning Git | Anna Skoulikari | O'Reilly Media | 2023 |
| 2 | Git Repository Management in 30 Days: Learn to manage code repositories like a pro | Sumit Jaiswal | BPB Publications | 2023 |
| 3 | Pro Git | Scoot Chacon | Apress | 2023 |

e-Resources:
https://pdfdrive.to/filedownload/mastering-git-a-beginners-guide-mastering-computer-science

## Semester: III
## Course Name: R PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **22CD383** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **02** |

**Pre-requisites:** Knowledge of basic computer hardware, Software and any programming language

**Course objectives:**
1. Explore and understand how R and R Studio interactive environment.
2. To learn and practice programming techniques using R programming.
3. Read Structured Data into R from various sources.
4. Understand the different data Structures, data types in R.
5. To develop small applications using R Programming.

**Module – 1** **03 Hours**

**Numeric, Arithmetic, Assignment and Vectors**: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

**Module - 2** **03 Hours**

**Matrices**: Defining a Matrix, Sub-setting, Matrix Operations
**Conditions and Looping**: if statements, looping with for, looping with while, vector based programming.

**Module – 3** **03 Hours**

**Lists and Data Frames**: Data Frames, Lists: Special values, The apply family.

**Module – 4** **03 Hours**

**Programming with Functions -1**: Functions, scope and its consequences, Arguments.

**Module – 5** **03 Hours**

**Programming with Functions-2**: Vector Based programming using functions, Recursive Programming, Debugging functions

**Course Outcomes:**
1. Apply the fundamentals of R Programming to solve basic mathematical functions.
2. Design and Develop R programs using branching and iterative statements.
3. Apply critical programming concepts to solve real life problems.
4. Demonstrate R programs using functions.
5. Develop simple applications using Vector Based Programming.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC | Jones, O., Maillardet. R. and Robinson.A | The R Series. | 2014 |
| **Reference Books** | | | | |
| 1 | Statistics: An Introduction using R | Michael J. Crawley | Wiley | Second edition, 2015 |

**e-Resources:**

Wickham, H. & Grolemund, G. (2018) for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz.
R programming for Beginners; **https://www.youtube.com/watch?v=fDRa82lxzaU**

## Semester: III
## Course Name: NATIONAL SERVICE SCHEME (NSS) - (3rd to 6th)

| | | | |
|---|---|---|---|
| Course Code | **22NS39** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P) | **0:0:3** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (SEE) | Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th Semester) | | |
| Credits | NCMC – Non Credit Mandatory Course<br>(Completion of the course shall be mandatory for the award of degree) | | |

**Course objectives:**
National Service Scheme (NSS) will enable the students to:
1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**General Instructions - Pedagogy:**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

**National Service Scheme (NSS) – Contents:**
1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

**NOTE:**
- Student / s in individual or in a group should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

**Semester wise from 3rd to 6th semester**
**Course Name: DISTRIBUTION OF ACTIVITIES**

| Semester | Topics / Activities to be Covered |
|---|---|
| 3rd Sem. | 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.<br>2. Waste management– Public, Private and Govt organization, 5 R's.<br>3. Setting of the information imparting club for women leading to contribution in social and economic issues. |
| 4th Sem. | 4. Water conservation techniques – Role of different stakeholders– Implementation.5<br>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.<br>6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. |
| 5th Sem. | 7. Developing Sustainable Water management system for rural areas and implementation approaches.<br>8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,<br>9. Spreading public awareness under rural outreach programs.(minimum5 programs).<br>10. Social connect and responsibilities. |
| 6th Sem. | 11. Plantation and adoption of plants. Know your plants.<br>12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).<br>13. Govt. school Rejuvenation and helping them to achieve good infrastructure. |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.**

| SN | Topic | Group size | Location | Activity execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers Land / Villages / Roadside / Community Area / College Campus Etc., | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 2. | Waste management– Public, Private and Govt. organization, 5 R's. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., , | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 3. | Setting of the information imparting club for women leading to contribution in social and economic issues. | May be individual or team | Women Empowerment Groups / Consulting NGOs & Govt. Teams / College Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 4. | Water conservation techniques – Role of different stakeholders– Implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 5. | Preparing an actionable business proposal for enhancing the village income and approach for implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 6. | Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. | May be individual or team | Local Government / Private / Aided Schools / Government Schemes Officers / Etc., | School selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 7. | Developing Sustainable Water management system for rural areas and implementation approaches. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. | Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc., | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 9. | Spreading public awareness under rural outreach programs (minimum5 programs) / Social connect and responsibilities. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 10. | Plantation and adoption of plants. Know your plants. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 11. | Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs). | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 12. | Govt. school Rejuvenation and helping them to achieve good infrastructure. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government/ Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

## Plan of Action (Execution of Activities for Each Semester)

| SN | Practice Session Description |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems / issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.
CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**SUGGESTED LEARNING RESOURCES:**
**Books:**
**NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
Government of Karnataka, NSS cell, activities reports and its manual.
Government of India, NSS cell, Activities reports and its manual.

**Semester: III**

Course Name: **PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I**

| | | | |
|---|---|---|---|
| Course Code | **22PE39** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional / state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

**Module I: Orientation** **05 Hours**

a. Lifestyle
b. Fitness
c. Food & Nutrition
d. Health & Wellness
e. Pre-Fitness test.

**Module II: General Fitness & Components of Fitness** **15 Hours**

a. Warming up (Free Hand exercises)
b. Strength – Push-up / Pull-ups
c. Speed – 30 Mtr Dash
d. Agility – Shuttle Run
e. Flexibility – Sit and Reach
f. Cardiovascular Endurance – Harvard step Test

**Module III: Recreational Activities** **10 Hours**

a. Postural deformities.
b. Stress management.
c. Aerobics.
d. Traditional Games.

**Semester III**

Course Name: **YOGA FOR A BETTER LIFE (3rd to 6th)**

| | | | |
|---|---|---|---|
| Course Code | **22YO39** | CIE Marks | 100 / Sem. |
| Teaching Hours / Week (L:T:P) | **0:0:2** | SEE Marks | --- |
| Total Hours of Pedagogy per semester | **24 - 28 hours (Theory + practical)** | Total Marks | 100 / Sem. |
| Examination nature (SEE): | **Objective type Theory / Practical / Viva-Voce** | | |

**Course objectives:**
1. To enable the student to have good health.
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.
5. To attain higher level of consciousness.

**The Health Benefits of Yoga**

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system
- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

## Semester III

## Course Name: YOGA SYLLABUS

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health

Rules to be followed during yogic practices by practitioner Yoga its misconceptions,
**Difference between yogic and non-yogic practices**
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**

a. Sitting: 1. Padmasana, 2. Vajrasana
b. Standing: 1. Vrikshana, 2. Trikonasana
c. Prone line: 1. Bhujangasana, 2. Shalabhasana
d. Supine line: 1. Utthitadvipadasana, 2. Ardhahalasana

**Semester IV**

Patanjali's Ashtanga Yoga, its need and importance.
Yama: Ahimsa, Satya, Asteya, Brahmacarya, Aparigraha
Niyama: Shoucha, Santosh, Tapa, Svaadhyaya, Eshvarapranidhan, Suryanamaskar12 Count- 4 Rounds of Practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**

a. Sitting: 1. Sukhasana, 2. Paschimottanasana
b. Standing: 1. Ardhakati Chakrasana, 2. Parshva Chakrasana
c. Prone line: 1. Dhanurasana,
d. Supine line: 1. Halasana, 2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes / min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama: 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana, 4. Chandra Bhedana 5. Nadishodhana

# Scheme of Teaching and Evaluation for

# B.E – IV Semester

# CSE (DATA SCIENCE)

# (2022 Scheme)

**Semester: IV**

Course Name: **BIOLOGY FOR ENGINEERS**

| | | | |
|---|---|---|---|
| Course Code | **22BB41** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P: S) | **3:0:0:** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **3** |
| Examination type (SEE) | **Theory** | | |

**Course objectives:**
- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning / inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical / hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR / VR / MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical / hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) / oral presentations.

**Module-1** **08 Hours**

**INTRODUCTION TO BIOLOGY:**
The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

**Module-2** **08 Hours**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):**
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents / detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

**Module-3** **08 Hours**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):**
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

| **Module-4** | **08 Hours** |
|---|---|
| **NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):** Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs). | |

| **Module-5** | **08 Hours** |
|---|---|
| **TRENDS IN BIOENGINEERING (QUALITATIVE):** Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). | |

**Course outcome (Course Skill Set)**

At the end of the course, the student will be able to :

1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

**Suggested Learning Resources:**

**Books**

- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

**Web links and Video Lectures (e-Resources):**

- https:// nptel.ac.in/courses/121106008
- https:// freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https:// ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https:// ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https:// www.coursera.org/courses?query=biology
- https:// onlinecourses.nptel.ac.in/noc19_ge31/preview
- https:// www.classcentral.com/subject/biology
- https:// www.futurelearn.com/courses/biology-basic-concepts

**Activity Based Learning (Suggested Activities in Class) / Practical Based learning**

- Group Discussion of Case studies
- Model Making and seminar / poster presentations
    - Design of novel device / equipment like Cellulose-based water filters, Filtration system

## Semester: IV
## Course Name: INTRODUCTION TO DATA SCIENCE

| | | | |
|---|---|---|---|
| Course Code | **22CD42** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40+20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**
Probability and Statistics
**Course objectives:**
1. Demonstrate the proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually.
2. Utilize the skills in data management by obtaining, cleaning and transforming the data.
3. Make use of machine learning models to solve the business-related challenges
4. Experiment with decision trees, neural network layers and data partition.
5. Demonstrate how social clustering shape individuals and groups in contemporary society

**Module – 1** **08 Hours**

**Introduction:** Data Science and Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, **Linear Algebra,** Vectors, Matrices, **Statistics,** Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, Probability, Dependence and Independence, Conditional Probability, Baye's Theorem, Random Variables, continuous Distributions, The Normal Distribution, The Central Limit Theorem.

**Module - 2** **08 Hours**

**Hypothesis and Inference;** Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, **Gradient Descent,** The Idea Behind Gradient Descent Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent, **Getting Data**, stdin and stdout, Reading Files, Scraping the Web, **Using APIs, Example**: Using the Twitter APIs, **Working with Data**, Exploring Your Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction.

**Module – 3** **08 Hours**

**Machine Learning;** Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, **k-Nearest Neighbors,** The Model, Example: The Iris Dataset, The Curse of Dimensionality, **Naive Bayes**, A Really Dumb Spam Filter, A More Sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, **Simple Linear Regression,** The Model, Using Gradient Descent, Maximum Likelihood Estimation, **Multiple Regression**, The Model, Further Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, **Logistic Regression**, The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines.

**Module – 4** **08 Hours**

**Decision Trees;** What Is a Decision Tree?, Entropy, The Entropy of a Partition, Creating a Decision Tree, Putting It All Together, Random Forests, **Neural Networks,** Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Fizz Buzz, **Deep Learning**, The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XOR Revisited, Other Activation Functions, Example: Fizz Buzz Revisited, Softmaxes and Cross-Entropy, Dropout, Example: MNIST, Saving and Loading Models, **Clustering,** The Idea, The Model, Example: Meetups, Choosing k, Example: Clustering Colors, Bottom-Up Hierarchical Clustering

**Module – 5** **08 Hours**

**Natural Language Processing:** Word Clouds, n-Gram Language Models, Grammars, An Aside: Gibbs Sampling, Topic Modeling, Word Vectors, Recurrent Neural Networks, Example: Using a Character-Level RNN, **Network Analysis,** Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, **Recommender Systems, Manual** Curation, Recommending What's Popular, User -Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization.

**PRACTICAL COMPONENT OF IPCC** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Installation of Python/R language, Visual Studio code editors can be demonstrated along with Kaggle data set usage.<br><br>Write programs in Python/R and Execute them in either Visual Studio Code or PyCharm Community Edition or any other suitable environment.<br><br>A study was conducted to understand the effect of number of hours the students spent studying on their performance in the final exams. Write a code to plot line chart with number of hours spent studying on x-axis and score in final exam on y-axis. Use a red `*' as the point character, label the axis and give the plot a title.<br><br>**Number of hours spent studying (x)**: 10, 9, 2, 15, 10, 16, 11, 16<br>**Score in the final exam (0 - 100) (y)**: 95, 80, 10, 50, 45, 98, 38, 93 |
| 2 | For the given dataset mtcars.csv (www.kaggle.com/ruiromanini/mtcars), plot a histogram to check the frequency distribution of the variable `mpg'(Miles per gallon)<br><br>Consider the books dataset BL-Flickr-Images-Book.csv from Kaggle (https://www.kaggle.com/adeyoyintemidayo/publication-of-books) which contains information about books. Write a program to demonstrate the following.<br>• Import the data into a DataFrame<br>• Find and drop the columns which are irrelevant for the book information.<br>• Change the Index of the DataFrame<br>• Tidy up fields in the data such as date of publication with the help of simple regular expression.<br>Combine str methods with NumPy to clean columns |
| 3 | Train a regularized logistic regression classifier on the iris dataset (https://archive.ics.uci.edu/ml/machine-learning-databases/iris/ or the inbuilt iris dataset) using sklearn. Train the model with the following hyperparameter C = 1e4 and report the best classification accuracy.<br><br>Train an SVM classifier on the iris dataset using skilearn. Try different kernels and the associated hyperparameters. Train model with the following set of hyperparameters RBF-kernel, gamma=0.5, one-vs-rest classifier, no-feature-normalization. Also try C=0.01,1,10 C=0.01, 1, 10. For the above set of hyperparameters, find the best classification accuracy along with total number of support vectors on the test data |

4 Consider the following dataset. Write a program to demonstrate the working of the decision tree based ID3 algorithm

| Price | Maintenance | Capacity | Airbag | Profitable |
|---|---|---|---|---|
| Low | Low | 2 | No | Yes |
| Low | Med | 4 | Yes | Yes |
| Low | Low | 4 | No | Yes |
| Low | Med | 4 | No | No |
| Low | High | 4 | No | No |
| Med | Med | 4 | No | No |
| Med | Med | 4 | Yes | Yes |
| Med | High | 2 | Yes | No |
| Med | High | 5 | No | Yes |
| High | Med | 4 | Yes | Yes |
| High | Med | 2 | Yes | Yes |
| High | High | 2 | Yes | No |
| High | High | 5 | Yes | Yes |

Consider the dataset spiral.txt (https://bit.ly/2Lm75Ly). The first two columns in the dataset corresponds to the co-ordinates of each data point. The third column corresponds to the actual cluster label. Compute the rand index for the following methods:

- K means Clustering
- Single link Hierarchical Clustering
- Complete link hierarchical clustering.
- Also visualize the dataset and which algorithm will be able to recover the true clusters.

**Course Outcomes:**

1. Identify and demonstrate data using visualization tools.
2. Make use of Statistical hypothesis tests to choose the properties of data, curate and manipulate data.
3. Utilize the skills of machine learning algorithms and techniques and develop models.
4. Demonstrate the construction of decision tree and data partition using clustering
5. Experiment with social network analysis and make use of natural language processing skills to develop data driven applications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Science from Scratch | Joel Grus | O`Relly Publications/ Shroff Publishers and Distributors Pvt. Ltd | 2nd Edition, 2019 |
| **Reference Books** | | | | |
| 1 | Build a Career in Data S | Emily Robinson and Jacqueline Nolis | Manning Publications | 1st Edition,2020 |
| 2 | Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. | AurelienGeron | O`Relly Publications/ Shroff Publishers and Distributors Pvt. Ltd | 2nd Edition, 2019 |
| 3 | Deep Learning with Python | Francois Chollet | Manning Publications | 1st Edition,2020 |
| 4 | Deep Learning for Coders with fastai and PyTorch | Jeremy Howard and Sylavain Gugger | O`Relly Publications/ Shroff Publishers and Distributors Pvt. Ltd | 1st Edition, 2020 |
| 5 | Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2 | Sebastian Raschka and Vahid Mirjalili | Packt Publishing Limited | 3rd Edition 2019 |

**e-Resources:**

1. Using Python; https://www.python.org
2. R Programming; https://www.r-project.org/
3. Python for Natural Language Processing; https://www.nltk.org/book/
4. Data set: https://bit.ly/2Lm75Ly
5. Data set: https://archive.ics.uci.edu/ml/datasets.html
6. Data set; www.kaggle.com/ruiromanini/mtcars
7. Pycharm; https://www.jetbrains.com/pycharm
8. https://nptel.ac.in/courses/106/106/106106179/
9. https://nptel.ac.in/courses/106/106/106106212/
10. http://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html

**Semester: IV**

**Course Name: DATABASE MANAGEMENT SYSTEMS**

| | | | |
|---|---|---|---|
| Course Code | **22CD43** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases**: Introduction, Characteristics of database approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS approach, History of database applications. When Not to Use a DBMS.
**Overview of Database** Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment, Centralized and Client/Server Architectures for DBMSs, Classification of Database Management Systems, Oracle and MySQL database architecture.

**Module - 2** **08 Hours**

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER Diagrams, Naming Conventions, and Design Issues, Example of Other Notation: UML Class Diagrams
**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

**Module – 3** **08 Hours**

**SQL**: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database. No SQL and difference between SQL and NOSQL.
**Advanced Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.
**Advanced Aggregation Features**: Ranking – dense rank, partition by.

**Module – 4** **08 Hours**

**SQL Programming Techniques:** Overview of Database Programming Techniques and Issues, Embedded SQL, Dynamic SQL, and SQLJ, JDBC: SQL Class Library for Java Programming, Database Stored Procedures.
**Normalization:** Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

**Module – 5** **08 Hours**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Transaction support in SQL.
**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

**PRACTICAL COMPONENT** **20 Hours**

**List of Experiments**

| | |
|---|---|
| 1 | Draw an E-R diagram and map it to relation table for a given scenario. (Order Database, Cricket Database, Movie Database, College Database, Voter Database, etc) |
| 2 | Normalize the tables. |
| 3 | Perform the following:<br>Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback) |
| 4 | Perform the following:<br>Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database. |
| 5 | For a given set of relation schemes, create tables and perform the following<br>i. Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions<br>ii. Join Queries- Inner Join, Outer Join<br>iii. Subqueries- With IN clause, With EXISTS and NOT EXISTS clause |
| 6 | For a given set of relation tables perform the following<br>Creating Views (with and without check option), Dropping views, Selecting from a view |
| 7 | Demonstrate the core concepts on table like procedure and trigger queries and also rank() function. |

**Reference:**
https://www.youtube.com/watch?v=AA-KL1jbMeY https://www.youtube.com/watch?v=7S_tz1z_5bA
https://www.youtube.com/watch?v=lBpSMeQjNqQ https://www.youtube.com/watch?v=_yog7h4BokQ
https://www.youtube.com/watch?v=hSiCUNVKJAo https://www.youtube.com/watch?v=IqQhPlJP64k
https://www.youtube.com/watch?v=horURQewW9c https://www.youtube.com/watch?v=P7-wKbKrAhk
https://www.youtube.com/watch?v=MSbzErdcb6g https://www.youtube.com/watch?v=QFj-hZi8MKk

**Course Outcomes:**
1. Demonstrate the basic elements of a relational database management system.
2. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
3. Create, populate and manage relational databases in SQL.
4. Extend normalization for the development of application software.
5. Analyze and implement transaction processing, concurrency control, and database recovery protocols in database.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry. F. Korth and S. Sudarshan | Tata McGraw Hill Education Private Limited | 6th Edition |
| Reference Books | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

**E-Resources:**
https://www.youtube.com/watch?v=wOD02sezmX8
https://www.youtube.com/watch?v=hlGoQC332VM
https://www.youtube.com/watch?v=NNpFHQl_GT0
https://www.youtube.com/watch?v=EGEwkad_llA
https://www.youtube.com/watch?v=t5hsV9lC1rU

## Semester: IV
## Course Name: ANALYSIS AND DESIGN OF ALGORITHMS

| | | | |
|---|---|---|---|
| Course Code | **22CD44** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **03** |

**Course Objectives**
1. Describe basic concepts, notations, methods used in design and analysis of algorithms
2. Explain various algorithm design techniques.
3. Design and analyze the efficiency of a given problem using various design techniques.
4. Differentiate efficiency of different algorithm design techniques for a given problem.
5. Apply the suitable algorithm design technique for a given problem.

**Module – 1** **08 Hours**

**Introduction:** Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithm, Mathematical Analysis of Recursive Algorithms.

**Module - 2** **08 Hours**

**Brute Force and Exhaustive Search:** Selection Sort and Bubble Sort, Exhaustive Search. **Decrease-and-Conquer:** Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decrease by-a-Constant-Factor Algorithms: Binary Search, Variable- Size-Decrease Algorithm: Euclids Algorithm

**Module – 3** **08 Hours**

**Divide-and-Conquer:** Recurrence equation for divide and conquer, Master Theorem, Finding the maximum and minimum, Mergesort, Quicksort, Binary Search, Strassen’s Matrix Multiplication. **Transform-and-Conquer:** Presorting, Heaps and Heapsort, Problem Reduction Computing the Least Common Multiple.

**Module – 4** **08 Hours**

**Greedy Method:** General method, Knapsack Problem, Job sequencing with deadlines, Prim’s Algorithm, Kruskal’s Algorithm, Dijkstra's Algorithm
**Dynamic Programming:** The Knapsack Problem, Warshall’s and Floyd’s Algorithms. Bellman- Ford Algorithm, Travelling Sales Person problem.

**Module – 5** **08 Hours**

**Backtracking:** *n*-Queens Problem, Subset-Sum Problem, Graph coloring, Hamiltonian cycles. **Branch-and-Bound:** Knapsack Problem, Traveling Salesman Problem, Job Assignment Problem. **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP- Complete, and NP-Hard classes.

**Course Outcomes:**
1. Apply the basic knowledge of mathematical fundamentals for finding time complexity of recursive and non-recursive algorithms.
2. Describe various algorithm design techniques to solve a given problem.
3. Apply various design techniques to find the time complexity of a given problem
4. Compare efficiency of different algorithm design techniques for a given problem
5. Choose the appropriate algorithm design techniques for a given problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to the Design and Analysis of Algorithms | Anany Levitin | Pearson | 2nd Edition, 2009 |
| 2 | Computer Algorithms/C++ | Ellis Horowitz, Satraj Sahni and Rajasekaran | Universities Press | 2nd Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein | PHI | 3rd Edition, 2009 |
| 2 | Design and Analysis of Algorithms | S. Sridhar | Oxford, Higher Education | 2014 |

**Semester: IV**
**Course Name: ALGORITHMS LAB**

| | | | |
|---|---|---|---|
| Course Code | **22CDL45** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Course Objectives:**
1. Demonstrate the basics concepts of Java Programming.
2. Illustrate Different Sorting Algorithm design techniques.
3. Solve Graph Applications using various design techniques.
4. Interpret combinatorial problems using Backtracking technique.
5. Develop skills to identify suitable algorithm design technique to solve a given problem

**List of Experiments:**
**Identify the functional requirements, then Design and Develop solutions to the problems related to the following Algorithm design techniques**

1. Brute Force technique
2. Decrease-and-Conquer method
3. Divide-and-Conquer technique
4. Transform-and-Conquer technique
5. Greedy Method
6. Dynamic Programming
7. Backtracking

**Course outcomes:**
- Design programs to implement basic concepts of java programs.
- Apply various algorithm design techniques to solve sorting problems.
- Implement graph Applications using various design techniques.
- Execute programs on combinatorial problems using Backtracking technique.
- Choose appropriate design technique to solve a given problem

**Semester: IV**
**Course Name: SYSTEM SOFTWARE**

| | | | |
|---|---|---|---|
| Course Code | **22CD461** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
1. Basic Computer organization and architecture
2. Basic concepts of Operating System
3. Good programming skills in C and data structures

**Course objectives**
1. Distinguish between system software and application software
2. Categorize the instruction formats and addressing modes of SIC and SIC/XE machine.
3. Write the object code for SIC and SIC/XE machine programs
4. List the steps involved to design a Bootstrap loader
5. Apply regular expressions to develop programs using LEX and YACC tools.

**Module – 1** **08 Hours**

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples. Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

**Module – 2** **08 Hours**

Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations – 1 Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.

**Module – 3** **08 Hours**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

**Module – 4** **08 Hours**

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

**Module – 5** **08 Hours**

| |
|---|
| Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running 43 LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.<br>Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens. |

**Course outcomes:**

1. Design programs to implement basic concepts of java programs.
2. Apply various algorithm design techniques to solve sorting problems.
3. Implement graph Applications using various design techniques.
4. Execute programs on combinatorial problems using Backtracking technique.
5. Choose appropriate design technique to solve a given problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | System Software | Leland L. Beck D Manjula | Pearson Education | 3rd Ed, 2012 |
| 2 | Lex and Yacc | John R. Levine,<br>Tony Mason and Doug Brown | O'Reilly | 2012 |
| **Reference Books** | | | | |
| 1 | System Programming and Operating Systems | D.M. Dhamdhere, | Tata McGraw - Hill | 3rd Ed, 2013. |
| 2 | Systems programming | Srimanta Pal | Oxford university press | 2016 |

## Semester: IV
## Course Name: OBJECT ORIENTED PROGRAMMING WITH PYTHON

| | | | |
|---|---|---|---|
| Course Code | **22CD462** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **3** | Exam Hours | **3** |

**Pre-requisites:**
- Basic Knowledge of Programming
- Basic Knowledge of MS word, Excel and PDF

**Course objectives**
1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples and dictionaries.
3. Demonstrate the use of built-in functions of file system.
4. Implement the Object Oriented Programming concepts in Python.
5. Appraise the need for working with various documents like Excel, PDF, Word and Others.

**Module – 1** **08 Hours**

**Python Basics**, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Module - 2** **08 Hours**

**Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods

**Module – 3** **08 Hours**

**Reading and Writing Files,** Files and File Paths, The os path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables withthe pprint. pformat() Function, Project: Generating Random Quiz Files, Project: Multi clipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

**Module – 4** **08 Hours**

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The_str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Module – 5** **08 Hours**

**Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module

**Course Outcomes:**

1. Demonstrate proficiency in handling of loops and creation of functions.
2. Identify the methods to create and manipulate lists, tuples and dictionaries.
3. Utilize built-in functions to navigate the file system.
4. Apply the concepts of Object-Oriented Programming to different applications
5. Develop proficiency in working with Excel spreadsheets, PDF and Word documents, CSV files, and JSON data

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist", | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press /Taylor & Francis | 1st Edition,2018 |

**e-Resources:**

https://automatetheboringstuff.com
http://greenteapress.com/thinkpython2/thinkpython2.pdf)

## Semester: IV
## Course Name: INTRODUCTION TO DATA ANALYTICS

| | | | |
|---|---|---|---|
| Course Code | **22CD463** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **3** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module – 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms. **Advanced data visualization-** structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools and Practices | Dr.Gaurav Aroraa Chitra Lele Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

## Semester: IV
## PROFESSIONAL SKILLS FOR THE WORK PLACE

| | | | |
|---|---|---|---|
| Course Code | **22PSW47** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **30** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
1. Basic Conversational English
2. Fundamentals of Mathematics
3. Basic Knowledge of Reasoning

**Module – 1** **06 Hours**

**Communication Skills**
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

**Module – 2** **06 Hours**

**Presentation Skills**
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

**Module – 3** **06 Hours**

**Verbal & Numerical Ability**
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

**Module – 4** **06 Hours**

**English Language**
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors.

**Module – 5** **06 Hours**

**Verbal Ability and Verbal Reasoning**
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

**Course Outcomes:**
1. Demonstrate communicative ability in a professional environment
2. Articulate one's ideas and demonstrate them to an audience
3. Transform one's English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Reasoning N' Reasoning - Verbal & Non-verbal Reasoning | Dr. Ravi Chopra | Galgotia | 1994 |
| 2 | Magical Book on Quicker Math | M. Tyra | BSC | I Edition, 2018 |
| 3 | Communicate With Confidence | Diana Booher | Mc-Graw-Hill | Nov 2011 |
| **Reference Books** | | | | |
| 1 | Cambridge Advanced Learner's Dictionary | Cambridge University Press | CBS | IV Edition, 2013 |
| 2 | A Modern Approach to Verbal and Non-verbal Reasoning | R S Agarwal | S Chand | II Edition, 2018 |
| 3 | Word Power Made Easy | Norman Lewis | Goyal Publishers | IV Edition, 2014 |
| 4 | Speak With Confidence | Diana Booher | Mc-Graw-Hill | I Edition, 2002 |

## Semester: IV
## UNIVERSAL HUMAN VALUES (UHV)

| | | | |
|---|---|---|---|
| Course Code | **22UH48** | CIE Marks | **50** |
| Teaching Hours / Week (L: T:P: S) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15 hour Theory Session +15 hour Self study** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01 Hour** |
| Examination type (SEE) | **SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions).** | | |

**Course objectives:**
This course is intended to:
1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evaluation.
7. Encourage the students for group work to improve their creative and analytical skills.

**Module-1** **03 hours**

**Introduction to Value Education:**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

**Module-2** **03 hours**

**Harmony in the Human Being :**
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

**Module-3** **03 hours**

**Harmony in the Family and Society :**
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

**Module-4** **03 hours**

**Harmony in the Nature / Existence:**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment
among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

**Module-5** **03 hours**

**Implications of the Holistic Understanding – a Look at Professional Ethics:**
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

**Course Outcome (Course Skill Set)**
At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**Expected to positively impact common graduate attributes like:**
- Ethical human conduct
- Socially responsible behaviour
- Holistic vision of life
- Environmentally responsible work
- Having Competence and Capabilities for Maintaining Health and Hygiene

**Appreciation and aspiration for excellence (merit) and gratitude for all**
**Suggested Learning Resources:**
**Books for READING:**
Text Book and Teachers Manual
- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
- The Teacher’s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

**Reference Books:**
- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews

**Semester: IV**

Course Name: **PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II**

| | | | |
|---|---|---|---|
| Course Code | **22PE49** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student’s choice.
3. Understand the roles and responsibilities of organization and administration of sports and games.

**Module IV: Ethics and Moral Values** **5 Hours**

Ethics in Sports
Moral Values in Sports and Games

**Module V: Specific Games (Any one to be selected by the student)** **20 Hours**

Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
Throw ball – Service, Receive, Spin attack, Net Drop & Jump throw.
Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.
Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.
Athletics (Track / Field Events) – Any event as per availability of Ground.

**Module VI: Role of Organization and Administration** **05 Hours**

** ** **

**Semester: III**

## Course Name: ADDITIONAL MATHEMATICS-I
## (For Lateral Entry Students)

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP31** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **00** | Exam Hours | **-** |

**Pre-requisites:**

1. Algebraic formulae
2. Differentiation
3. Integration
4. Trigonometric formulae

**Module – 1** **08 Hours**

**Linear Algebra**
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
**Self-Study:** Gauss Jordon Method

**Module - 2** **08 Hours**

**Differential Calculus:**
Review of successive differentiation-Illustrative examples. Maclaurin’s series expansions-Illustrative examples. Partial Differentiation: Euler’s theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
**Self-Study:** Taylor's series expansion.

**Module – 3** **08 Hours**

**Vector Differentiation:**
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields- Problems.
**Self-Study:** Angle between two surfaces[RBT Levels: L1, L2,L3]

**Module – 4** **08 Hours**

**Integral Calculus:**
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\, Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
**Self-Study:** Change of Order of Integration.

**Module – 5** **08 Hours**

**Ordinary Differential Equations:**
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli’s equation.
**Self-Study:** Homogeneous differential equations

**Course outcomes:**

1. Upon Completion of this course, student will be able to,
2. Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.
3. Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
4. Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
5. Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
6. Solve first order linear differential equations analytically using standard methods.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | $43^{rd}$ Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | John Willy & Sons | $10^{th}$ Ed. (Reprint). 2016 |
| 3 | Additional Mathematics-1 | Dr. Pandurangappa | Sanguine Technical Publishers | $4^{th}$ Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V. Ramana | Tata McGraw-Hill | $11^{th}$ Edition.2010 |

## Semester: IV
## Course Name: ADDITIONAL MATHEMATICS-II
## (For Lateral Entry Students)

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP41** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **0** | Exam Hours | **-** |

**Pre-requisites:**
1. Differentiation
2. Integration
3. Trigonometric formulae
4. Differential equations

**Module – 1** **08 Hours**

**Higher Order ODE's**
Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$
**Self-Study:** Finding particular Integral for $\phi(x) = x^m$

**Module – 2** **08 Hours**

**Partial Differential Equations (PDE's):**
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDE involving derivative with respect to one independent variable only.
**Self-Study:** Method of separation of variables

**Module – 3** **08 Hours**

**Laplace Transform:**
Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t), t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.
Inverse Laplace Transform: Definition, Inverse Laplace Transform of standard functions. Inverse transform by Partial Fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.
**Self-Study:** Convolution Theorem.

**Module – 4** **08 Hours**

**Numerical Methods:**
Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.
Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula without proof problems.
**Numerical Integration:** Simpson's $1/3^{rd}$ and $3/8^{th}$ rule (without proof) - problems.
**Self-Study:** Weddle's Rule

**Module – 5** **08 Hours**

**Probability:**
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem. Problems.
**Self-Study:** Applications of Bayes' theorem

**Course outcomes:**
1. Upon completion of this course, student will be able to,
2. Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
3. Construct a variety of partial differential equations and solution by various methods.
4. Use Laplace Transform and inverse Laplace Transform in solving differential /integral equation arising in network analysis, control systems and other fields of engineering
5. Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
6. Use the concepts of probability in different probability distribution.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43$^{rd}$ Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | Jhon willy & Sons | 10$^{th}$ Ed. (Reprint) 2016 |
| 3 | Additional Mathematics-2 | Dr. Pandurangappa | Sanguine Technical Publishers | 4$^{Th}$ Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V.Ramana | Tata McGraw-Hill | 11$^{th}$ Edition.2010 |

**SUGGESTED TEACHING LEARNING PROCESS**

**The faculty members are suggested to use appropriately the following Teaching Learning methods:**
1. Active Learning
2. Chalk and Board for Numerical
3. Demonstration using simulator
4. Laboratory Demonstrations
5. Power Point Presentations
6. Problem based learning
7. Video Lecturers

*** *** ****

# Assessment Details

**1. Integrated professional Core Courses (IPCC):**
**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| X | Total Marks for theory component A+B | | | 30 |

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| Y | Total Marks | | 20 |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**2. Professional Core / Basic Science /ESC/ETC/PLC courses (Theory):**
**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B) = 30 + 20 = 50**
**Semester End Examination (SEE)**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE.
- Marks secured will be scaled down to 50.

**3. Professional Core Course (PCC) Lab/Ability Enhancement course (Lab):**
**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. Marks distribution: Procedure (15%) + Execution (70%) + Viva Voce (15%)

**4. Ability Enhancement Course (AEC)/Skill Enhancement course (SEC) (Theory), Universal human values Course (22UH48):**
**Assessment Details of CIE**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**
**SEE Guidelines for the Courses**
SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

**Suggested Alternate Assessment Tools for PCC, IPCC and AEC Courses:**

1. Quiz
2. Assignments
3. Seminars / Presentations
4. Paper Publications
5. Mini Projects
6. MOOCs
7. Industrial Visits and Report Writing
8. Self-learning with Certifications and
9. Cooperative and problem based learning.

**No SEE for the Courses: Social Connect and Responsibility (22SC37), NSS, YOGA, Sports and Athletics.**

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT, BALLARI
## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

B.E. in Computer Science & Engineering
Scheme of Teaching and Examinations - 2022
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

III SEMESTER

| S.N | Course | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | SDA (S) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BSC | 22MCS31 | Graph theory and Discrete Mathematical Structures | TD: Maths, PSB: Maths | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CS32 | Digital System Design and Computer Organization | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CS33 | Operating System | TD & PSB: CSE /AIML /CS[AI],CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CS34 | Data Structures and Applications | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CSL35 | Data Structures Lab | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CS36 | ESC/ETC/PLC **Object Oriented Programming With JAVA** | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22CS37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC/ SEC | 22CS38X | Ability Enhancement Course / SkillEnhancement Course - III | TD & PSB: CSE /AIML / CS[AI],CS[DS] | If the course is a Theory: 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | | | | | If the course is a Laboratory: 0 | 0 | 2 | | 02 | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | ... | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | Total | 550 | 350 | 900 | 20 |

| Ability Enhancement Course – III | | | |
|---|---|---|---|
| 22CS381 | Unix and Shell Programming | 22CS382 | Version Controller with GiT |
| 22CS383 | R Programming | | |

Head of the Department,
Dept. of Computer Science & Engg.
Ballari Institute of Technology & Management
(formerly Bellary Engineering College)
BELLARY

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT, BALLARI
## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

B.E. in Computer Science & Engineering Scheme
of Teaching and Examinations - 2022
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

IV SEMESTER

| SN | Course and Course Code | | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | Self Study (S) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BSC | 22BB41 | Biology for Engineers | TD & PSB: | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22CS42 | Micro Controllers and Embedded System | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22CS43 | Database Management Systems | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22CS44 | Analysis and Design of Algorithms | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22CSL45 | Algorithms Lab | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22CS46X | ESC/ETC/PLC | TD & PSB: CSE /AIML / CS[AI],CS[DS] | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | AEC / SEC | **22SSA47** | **Soft Skill & Aptitude** | TD & PSB: H & S | If the course is a Theory: 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | | | | | If the course is a Laboratory: 0 | 0 | 2 | | 02 | | | | |
| 8 | UHV | 22UH48 | Universal human values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | 22NS49 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE49 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Yoga | Yoga Teacher | | | | | | | | | |
| | | | | | | | | | Total | 500 | 400 | 900 | 20 |

**Engineering Science Course (ESC/ETC/PLC)**

| | | | |
|---|---|---|---|
| 22CS461 | System Software | 22CS462 | Object Oriented Programming with Python |
| 22CS463 | Introduction to Data Analytics | | |

Head of the Department,
Dept. of Computer Science & Engg.
... Technology & Management,

**Semester: III**

Course Name: **DIGITAL SYSTEM DESIGN AND COMPUTER ORGANIZATION**

| | | | |
|---|---|---|---|
| Course Code | 22CS32 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 + 20 | Total Marks | 100 |
| Credits | 4 | Exam Hours | 03 |

## Pre-requisites:

1. Basic Electronics
2. Basic Structure of Computer.

## Course objectives:

1. Illustrate different simplifying techniques in the design of combinational circuits.
2. Design various combinational and sequential digital circuits.
3. Design various counters using Flip-Flops.
4. Demonstrate the fundamentals of computer organization with machine instructions.
5. Elaborate the communication of input/output devices with computer system and solve arithmetic Operations using various techniques.

### Module – 1

**Karnaugh Maps:** minimum forms of switching functions, two and three variable Karnaugh maps, four variable Karnaugh maps, determination of minimum expressions using essential prime implicants, Quine-McCuskey Method: determination of prime implicants, the prime implicant chart, simplification using map-entered variables
**Textbook 1:** Part B: Chapter 5 (5.1 to 5.4) Chapter 6 (6.1, 6.2 and 6.5)

**8 Hours**

### Module - 2

**Multiplexers, Decoders and Programmable Logic Devices:** Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.
**Latches and Flip-Flops:** Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop, SR Flip Flop, J K Flip Flop, T Flip Flop.
**Textbook 1:** Part B: Chapter 9 (Sections 9.1 to 9.4, 9.6)
**Textbook 1:** Part B: Chapter 11 (Sections 11.1 to 11.7)

**8 Hours**

### Module – 3

**Register and Counters:** Register and register transfers, Shift registers
**Counters:** design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops. Sequential parity checker
**Textbook 1:** Part B: Chapter 12 (12.1 - 12.5), Chapter 13 (13.1)

**8 Hours**

### Module – 4

**Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes
**Textbook 2:** Chapter1 – 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), Chapter 2 – (2.2 to 2.5)

**8 Hours**

## Module – 5

**Input/output Organization:** Accessing I/O Devices, Interrupts, Direct Memory Access, Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth algorithm.
**Textbook 2:** Chapter 4 - (4.1, 4.2, 4.4)
**Textbook 2:** Chapter 2 - (2.1), Chapter 6 (6.1 to 6.4)

**8 Hours**

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | a) Realize 3-Variable and 4-variable Boolean expressions, simplify it using K-map and Implement using basic gates.<br>b) Simulate and verify the working of above expressions using VHDL |
| 2 | a) Design and implement Half adder and Full Adder using basic gates.<br>b) Simulate and verify the working of Half adder and Full Adder using VHDL |
| 3 | a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer.<br>b) Simulate and verify the working of 8:1 multiplexer using VHDL |
| 4 | a) Design and implement the Binary to Gray Code converter using basic gates.<br>b) Simulate and verify the working of Binary to Gray Code converter using VHDL |
| 5 | a) Design and implement the Truth Table of a 3-bit Parity Generator and 4-bit Parity Checker with an even parity bit using basic Gates. |
| 6 | a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.<br>b) Simulate and verify the working of D Flip-Flop with positive edge triggering using VHDL. |
| 7 | a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-flop ICs<br>b) Simulate and verify the working of mod-8 up counter using VHDL. |
| 8 | a) Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC7447).<br>b) Simulate and verify the working of Switched tail counter using VHDL |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Analog and Digital Electronics | Charles H Roth and Larry L Kinney | Cengage Learning | 2019 |
| 2 | Computer Organization | Carl Hamacher, Zvonko Vranesic, Safwat Zaky | Tata McGraw Hill | 5th Edition 2002 |
| **Reference Books** | | | | |
| 1 | Digital Principles and Applications, | Donald P Leach, Albert Paul Malvino & Goutam Saha | Tata McGraw Hill, | 8th Edition 2015 |
| 2 | Computer Organization & Architecture, Pearson | William Stallings | | 9th Edition |

## e-Resources:

1. http://lms.vtu.ac.in/econtent/CSE.php

**Semester: III**

**Course Name: OPERATING SYSTEM**

| | | | |
|---|---|---|---|
| Course Code | 22CS33 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 + 20 | Exam Hours | 3 |
| Credits | 4 | Total Marks | 100 |

**Pre-requisites:** The students should have the knowledge of:
1. Basics of computer system and its applications
2. Basics of computer organization

**Course objectives:**
1 To introduce operating system, OS responsibilities, and OS services.
2 To discuss process concept, process scheduling techniques, and multi-threading concepts.
3 To demonstrate deadlock condition in the computer system, and usage of main memory.
4 To introduce virtual memory management concepts and file system.
5 To explain about secondary storage system and Linux OS as a case study.

## Module – 1

- **Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems;
- **Operating System Services**: User - Operating system interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating system structure; Virtual machines; System boot.

**8 Hours**

## Module - 2

- **Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication.
- **Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; thread scheduling.
- **Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; threading issues.

**8 Hours**

## Module – 3

- **Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.
- **Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

**8 Hours**

## Module – 4

- **Virtual Memory Management**: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.
- **File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**8 Hours**

## Module – 5

- **Secondary Storage Structures, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management.
- **Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

**8 Hours**

**PRACTICAL COMPONENT 20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Install an operating system on a physical or logical (virtual) machine. |
| 2 | Design, develop and implement program to simulate the working of Shortest Remaining Time First scheduling algorithm. Experiment with different length jobs. |
| 3 | Design, develop and implement program to simulate the working of Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm. |
| 4 | Design, develop and implement a Banker's algorithm. Assume suitable input required to demonstrate the results. |
| 5 | Design, develop and implement page replacement using FIFO algorithms. Assume suitable input required to demonstrate the results. |
| 6 | Design, develop and implement page replacement using LRU algorithms. Assume suitable input required to demonstrate the results. |

| | |
|---|---|
| 7 | Design, develop and implement optimal page replacement algorithms. Assume suitable input required to demonstrate the results. |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed, , 2013. |
| 2 | An Introduction to Operating Systems: Concepts and Practice | P.C.P. Bhatt | PHI(EEE) | 4th Edition, 2014 |

**E-Resources:**

1 https://www.operating-system.org/
2 https://blog.feedspot.com/operating_system_blogs/
3 https://www.youtube.com/playlist?list=PLhqPDa2HoaAZLws7PFYWI4MnzCyHf8do-
4 https://medium.com/javarevisited/6-best-operating-system-courses-for-beginners-to-learn-7d727882d267

## Semester: III

## Course Name: DATA STRUCTURES AND APPLICATIONS

| | | | |
|---|---|---|---|
| Course Code | **22CS34** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Review of C Language:** Arrays, Structures & Unions, Pointers and Dynamic memory allocation
**Introduction to Data Structures:** Classifications of Data Structures, Data structure operations: Traversing, inserting, deleting, searching and sorting.
**Applications:** Representation of Polynomials and Sparse Matrices

**8 Hours**

**Module - 2**

**Stacks:**Stack Operations, Array Representation of Stacks, Different types of expression: Infix, Postfix and Prefix.
**Stack Applications:** Infix to postfix conversion, Infix to prefix conversion, Evaluation of postfix expression, Recursion.
**Queues:**Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues.

**8 Hours**

**Module – 3**

**Linked Lists:**Classification of linked lists. Representation of different types of linked lists in Memory. Traversing, Insertion, Deletion, Searching, Sorting and Concatenation Operations on Singly linked list. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues.
**Applications of Linked lists** – Polynomials, Sparse matrix representation.

**8 Hours**

**Module – 4**

**Trees 1:**Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder;
**Threaded binary trees**
**Binary Search Trees:** Binary Search Trees, Insertion, Deletion, Traversal and Searching operations on Binary search tree. Application of Trees: - Evaluation of Expression.

**8 Hours**

**Module – 5**

**Graphs:** Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
**Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | $2^{nd}$Ed, 2014 |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | $2^{nd}$Ed, 2014 |
| **Reference Books** | | | | |
| 1 | Data Structures using C | ReemaThareja | Oxford press | $3^{rd}$Ed 2012 |
| 2 | Data Structures using C | A M Tenenbaum | PHI | 2001 |

## Semester: III
## Course Name: DATA STRUCTURES LAB

| | | | |
|---|---|---|---|
| Course Code | 22CSL35 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 1 | Exam Hours | 03 |

**List of Experiments:**

**Identify the functional requirements, then Design and Develop solutions to the following list of problems**

| SN | Experiments |
|---|---|
| 1 | Design, Develop and Implement a menu driven Program in C Language for the following array operations.<br>a. Creating an array of N Integer Elements<br>b. Display of array Elements with Suitable Headings<br>c. Inserting an Element (ELEM) at a given valid Position (POS)<br>d. Deleting an Element at a given valid Position (POS)<br>e. Exit.<br>Support the program with functions for each of the above operations |
| 2 | Design, Develop and Implement a menu driven Program in C Language for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)<br>a. Push an Element on to Stack<br>b. Pop an Element from Stack<br>c. Demonstrate Overflow and Underflow situations on Stack<br>d. Display the status of Stack<br>e. Exit<br>Support the program with appropriate functions for each of the above operations |
| 3 | Design, Develop and Implement a Program in C Language for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands. |
| 4 | Design, Develop and Implement a Program in C Language for Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ |
| 5 | Design, Develop and Implement a Program in C Language using Recursion for<br>a. Generating Fibonacci series of n numbers<br>b. Solving Tower of Hanoi problem with n disks |
| 6 | Design, Develop and Implement a menu driven Program in C Language for the following operations on QUEUE of Integers (Array Implementation of Queue with maximum size MAX)<br>a. Insert an Element on to QUEUE<br>b. Delete an Element from QUEUE<br>c. Demonstrate Overflow and Underflow situations on QUEUE<br>d. Display the status of QUEUE<br>e. Exit<br>Support the program with appropriate functions for each of the above operations |
| 7 | Design, Develop and Implement a menu driven Program in C Language for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)<br>a. Insert an Element on to Circular QUEUE<br>b. Delete an Element from Circular QUEUE<br>c. Demonstrate Overflow and Underflow situations on Circular QUEUE<br>d. Display the status of Circular QUEUE<br>e. Exit<br>Support the program with appropriate functions for each of the above operations |
| 8 | Design, Develop and Implement a menu driven Program in C Language for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo<br>a. Create a SLL of N Students Data by using front insertion.<br>b. Display the status of SLL and count the number of nodes in it |

| | |
|---|---|
| | c. Perform Insertion / Deletion at End of SLL<br>d. Perform Insertion / Deletion at Front of SLL (Demonstration of stack)<br>e. Exit |

**Semester: III**

Course Name: **OBJECT ORIENTED PROGRAMMING WITH JAVA**

| | | | |
|---|---|---|---|
| Course Code | 22CS361 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 |

**Pre-requisites:**

Students should know the basic knowledge on:

- C Programming
- C++

**Course objectives:**

1. Learn fundamental features of object-oriented language and JAVA.
2. Learn object-oriented concepts using programming examples.
3. Study the concepts of importing packages, exception handling mechanism and multithreading.
4. Introduce event handling mechanism.
5. Create Graphical User Interface (GUI) applications using swings.

**Module – 1**

**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.
**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses.
**Control Statements:** Java's Selection Statements, Iteration Statements
**Text book 1: Ch 3, Ch 4, Ch 5**

**8 Hours**

**Module - 2**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, "This" Keyword, Garbage Collection.
**A Closer Look at Methods and Classes:** Overloading Methods.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.
**Text book 1: Ch6, Ch 7, Ch 8**

**8 Hours**

**Module – 3**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces.
**ExceptionHandling:**Exception-HandlingFundamentals,ExceptionTypes,UncaughtExceptions,Usingtryandcatch,MultiplecatchClauses,NestedtryStatements,throw, throws,finally,Java'sBuilt-inExceptions,CreatingYourOwnExceptionSubclasses,ChainedExceptions, Using Exceptions.
**Multithreaded Programming:** The Java Thread Model ,The Main Thread,Creating a Thread, Creating Multiple Threads ,Using isAlive() and join(),Thread Priorities.
**Text book 1: Ch 9, Ch 10,Ch 11**

**8 Hours**

**Module – 4**

**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model; Event Classes,Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, AdapterClasses,InnerClasses.
**Text book 1: Ch 23**

**8 Hours**

**Module – 5**

**Introducing Swings:** The Origins of Swing, Two Key Swing Features, Components and Containers,TheSwing Packages; A Simple Swing Application, Create a Swing Applet.
**Exploring Swings:** Jlabel and ImageIcon,JTextField, TheSwing Buttons, JTabbedpane,JList,JComboBox,JTable.
**Text book 1: Ch 30, Ch 31**

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | JavaTheCompleteReference | HerbertSchildt | TheMcGrawHill | 8thEdition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balagurusamy | Tata McGraw Hill | 3rd Edition,2007 |

**e-Resources:**
1. Howtoinstalljava:-https://youtu.be/IJ-PJbvJBGs
2. JavaSwings:-https://youtu.be/TwMXA1S38qg
3. JavaQuiz:-https://www.w3schools.com/java/java_quiz.asp
4. JavaConcepts:-https://www.javatpoint.com/java-tutorial
ProgrammingExercises:-https://www.programiz.com/java-programming/examples

## Semester: III
## Course Name: UNIX AND SHELL PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | 22CS381 | CIE Marks | 50 |
| Teaching Hours/Week (L: T :P) | 1:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 15 | Total Marks | 100 |
| Credits | 1 | Exam Hours | 02 |

**Pre-requisites:**
Knowledge of DOS and Windows

**Module – 1**

**Introduction**, Brief history, Unix Architecture, Features of Unix, locating commands, Command structure, Internal and External commands, man command, Understanding the man documentation, **Basic commands** such as cal, date, echo, printf, passwd, who, wc, ls.

**3 Hours**

**Module - 2**

**Unix files:** Basic file types, Parent-child relationship, the home directory, PATH variable. Relative and absolute pathnames.
**Directory commands** – pwd, cd, mkdir, rmdir commands,
**File related commands** – cat, cp, rm, mv.

**3 Hours**

**Module – 3**

**File Types & Permission:**
The ls -l command, -d options, File ownership, File permissions, chmod, Directory permissions, changing File ownership.
**The vi editor:** Different modes of vi, Input mode commands, Command mode commands, ex-mode commands, Repeat command, Pattern searching, Search and Replace command.

**3 Hours**

**Module – 4**

**The shells interpretive cycle**: Wild cards, Escaping and Quoting, Three standard files and redirection, Pipe, tee, Command substitution.
**Shell programming:** Ordinary and environment variables, read command, Command line arguments, exit and exit status of a command, Logical operators for conditional execution, test command and its shortcut, if, expr, while, for, and case-control statements, set and shift commands, positional parameters.

**3 Hours**

**Module – 5**

**Process:** Basics, Mechanism of process creation, Parent and child process, The ps command with its options, Signals, Job control.
**File Links:** Hard link and soft link, umask, head, tail, cut, paste, sort and grep commands.

**3 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Unix Concepts and Applications | Sumitabha Das | Tata McGraw Hill | 4th Edition |

**Semester: III**

**Course Name: VERSION CONTROLLER with GiT**

| | | | |
|---|---|---|---|
| Course Code | **22CS382** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 15 | Total Marks | 100 |
| Credits | 1 | Exam Hours | 2 |

**Pre-requisites:**

- Basic knowledge of computer hardware and software
- Basic knowledge of programming

**Course objectives:**

**Module – 1**

**Getting Started:** Version Control Basics, What Is Git?, Advantages Of Git, Disadvantages Of Git. **The Basics:** Installing Git, First Time Git Set Up, Tips And Troubleshooting

**3 Hours**

**Module - 2**

**Working with Repositories:** What Are Git Repositories?, Recording Changes To Repos, Working With Remotes, Git Aliases, Tagging

**3 Hours**

**Module - 3**

**Working with Branches:** What Are Branches?, Branching And Merging, Branch Workflows, Remote Branches

**3 Hours**

**Module – 4**

**Working with Servers:** Getting Git On Server, Server Setup, Distributed Git And Projects

**3 Hours**

**Module – 5**

**GitHub:** What Is Github?, History Of Github, How To Use Github, Different Types Of Accounts

**3 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Git: A Beginner's Guide | Sumanna Kaul, Shahryar Raz, and Divya Sachdeva | CRC Press | 2022 |
| **Reference Books** | | | | |
| 1 | Learning Git | Anna Skoulikari | O'Reilly Media | 2023 |
| 2 | Git Repository Management in 30 Days: Learn to manage code repositories like a pro | Sumit Jaiswal | BPB Publications | 2023 |
| 3 | Pro Git | Scoot Chacon | Apress | 2023 |

**e-Resources: https://pdfdrive.to/filedownload/mastering-git-a-beginners-guide-mastering-computer-science**

**Semester: III**

Course Name: **R Programming**

| | | | |
|---|---|---|---|
| Course Code | 22CS383 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 15 | Total Marks | 100 |
| Credits | 1 | Exam Hours | 02 |

**Pre-requisites:** Knowledge of basic computer hardware, Software and any programming language

**Course objectives:**
1. Explore and understand how R and R Studio interactive environment.
2. To learn and practice programming techniques using R programming.
3. Read Structured Data into R from various sources.
4. Understand the different data Structures, data types in R.
5. To develop small applications using R Programming.

**Module – 1**

**Numeric, Arithmetic, Assignment, and Vectors**: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

**03 Hours**

**Module - 2**

**Matrices**: Defining a Matrix, Sub-setting, Matrix Operations
**Conditions and Looping**: if statements, looping with for, looping with while, vector based programming.

**03 Hours**

**Module – 3**

**Lists and Data Frames**: Data Frames, Lists: Special values, The apply family.

**03 Hours**

**Module – 4**

**Programming with Functions -1**: Functions, scope and its consequences, Arguments.

**03 Hours**

**Module – 5**

**Programming with Functions -2**: Vector Based programming using functions, Recursive Programming, Debugging functions

**03 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC | Jones, O., Maillardet. R. and Robinson.A | The R Series. | 2014 |
| **Reference Books** | | | | |
| 1 | Statistics: An Introduction using R | Michael J. Crawley | Wiley | Second edition, 2015 |
| | | | | |

**e-Resources:**

1. Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz.
2. R programming for Beginners **:** **https://www.youtube.com/watch?v=fDRa82lxzaU**

**Semester: IV**

Course Name: **MICROCONTROLLER AND EMBEDDED SYSTEMS**

| | | | |
|---|---|---|---|
| Course Code: | **22CS42** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 + 20 | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Pre-requisites:**

- Basics of embedded system and Microcontroller.
- Types of Processor.
- Basics of assembly language.

**Course objectives:**

1. Explain the fundamentals of ARM based systems.
2. Utilize instruction set of ARM controller with examples.
3. Identify various embedded system components, their purpose and applications.
4. Demonstrate the use of Embedded System design concepts with examples.
5. Outline the real time operating system concepts used in the embedded system.

**Module – 1**

**Microprocessors versus Microcontrollers, ARM Embedded Systems**: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. **ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions

**Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5**

**8 Hours**

**Module - 2**

**Introduction to the ARM Instruction Set:** Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants

**Textbook 1: Chapter 3: Sections 3.1 to 3.6 (Excluding 3.5.2)**

**8 Hours**

**Module – 3**

**Embedded System Components:** Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.

**Textbook 2: Chapter 1 (Sections 1.2 to 1.6), Chapter 2 (Sections 2.1 to 2.6)**

**8 Hours**

**Module – 4**

| |
|---|
| **Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling<br>**Text book 2: Chapter-3, Chapter-4, Chapter-7 (Sections 7.1, 7.2 only)**<br>**8 Hours** |

**Module – 5**

| |
|---|
| RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only definitions of thread standards), Thread preemption, Multiprocessing and Multitasking, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores ( Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler /decompiler, simulator, emulator and debugging techniques, target hardware debugging.<br>**Textbook 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 ( block diagram before 13.1, 13.3, 13.4, 13.5)**<br>**8 Hours** |

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Write a program to add, subtract and multiply two 16-bit binary numbers. |
| 2 | Write a program to find the sum of first 10 integer numbers |
| 3 | Write a program to find Fibonacci series up to a given number |
| 4 | Write a program to add an array of 16-bit numbers and store the 32-bit result in internal RAM |
| 5 | Write a program to find the square of a number (1 to 10) using look-up table. |
| 6 | Interface and Control a DC Motor. |
| 7 | Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction |
| 8 | Interface and control a Buzzer ON and OFF |
| 9 | Demonstrate the use of an external interrupt to toggle an LED On/Off. |
| 10 | Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between. |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | ARM system developers guide, | Andrew N Sloss, Dominic Symes and Chris Wright | Elsevier, Morgan Kaufman publishers | 2008. |

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|---|---|---|---|---|
| 2 | Introduction to Embedded Systems | Shibu K V | Tata McGraw Hill Education, Private Limited | 2nd Edition |
| **Reference Books** | | | | |
| 1 | Embedded System | Raj Kamal, | Tata McGraw-Hill Publishers | 2nd Edition, 2008 |
| 2 | ARM System-on-Chip Architecture | Steve Furber | Pearson, | Second Edition, 2015 |

**e-Resources:**

1. https://www.youtube.com/watch?v=4VRtujwa_b8 **(ARM-1)**
2. https://www.youtube.com/watch?v=VcQl0UPC7S0 **(ARM-2)**
3. https://www.youtube.com/playlist?list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU **(Embedded system design with ARM)**
4. https://www.youtube.com/playlist?list=PLKbSRxrdxkT3sRzWE465KoxOH00BFbRs6 **(Embedded C programming tutorial)**
5. https://www.youtube.com/playlist?list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU **(Embedded system design with ARM)**

**Semester: 4th**

Course Name: **DATABASE MANAGEMENT SYSTEMS**

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|---|---|---|---|
| Course Code | **22CS43** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40 + 20** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:**

- Knowledge of programming
- Data structures

**Course objectives:**

1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

**Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7**

**8 Hours**

**Teaching-Learning Process: Chalk and board, Active Learning, Problem based learning**

**Module - 2**

**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping

**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Textbook 1: Ch 5.1 to 5.3, Ch 9.1; Textbook 2: Ch 3.1 to 3.9**

**8 Hours**

**Teaching-Learning Process: Chalk and board, Active Learning, Demonstration**

**Module – 3**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

**Advanced Aggregation Features:** Ranking – dense rank, partition by

**Application Development:** Accessing SQL From a Programming Language, An introduction to JDBC, ODBC, Embedded SQL, SQLJ, Stored procedures

**Textbook 1: 7.1 to 7.4; Textbook 2: 5.1, 5.2, 5.5**

**8 Hours**

**Teaching-Learning Process: Chalk and board, Problem based learning, Demonstration**

**Module – 4**

**Normalization: Database Design Theory –** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

**Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

**Textbook 1: Ch 14.1 to -14.7, 15.1 to 15.6**

**8 Hours**

**Teaching-Learning Process: Chalk & board, Problem based learning**

**Module – 5**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency

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| control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.<br><br>**Textbook 1: Ch 20.1 to 20.6, 21.1 to 21.7;**<br>**8 Hours** |
| **Teaching-Learning Process: Chalk and board, MOOC** |

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Aim: Discuss the various concepts on constraints and update operations.<br>Program: Consider the following schema for Order Database:<br>SALESMAN(Salesman_id, Name, City, Commission)<br>CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)<br>ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)<br>Write SQL queries to<br>1. Count the customers with grades above Bangalore's average.<br>2. Find the name and numbers of all salesman who had more than one customer.<br>3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)<br>4. Create a view that finds the salesman who has the customer with the highest order of a day.<br>5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.<br>Reference:<br>https://www.youtube.com/watch?v=AA-KL1jbMeY<br>https://www.youtube.com/watch?v=7S_tz1z_5bA |
| 2 | Aim: Demonstrating creation of tables, applying the nested query concepts.<br>Program Consider the following schema for a Cricket Database:<br>TEAM( tid, tname, coach, captain_pid , city)<br>PLAYER( pid, pname, age, tid)<br>STADIUM(sid, sname, pincode, city)<br>MATCH(mid, mdate, time, sid, team1_id, team2_id, winning_team_id, man_of_match, pid)<br>Write SQL queries to<br>1. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.<br>2. List the details of the stadium where the maximum number of matches were played.<br>3. List the details of the player who is not a captain but got the man_of _match award at least in two matches.<br>4. Display the Team details who won the maximum matches.<br>5. Display the team name where all its won matches played in the same stadium.<br>Reference:<br>https://www.youtube.com/watch?v=IBpSMeQjNqQ<br>https://www.youtube.com/watch?v=_yog7h4BokQ |

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|---|---|
| 3 | Aim: Demonstrate the concepts of JOIN operations.<br>Program: Consider the schema for Movie Database:<br>ACTOR(Act_id, Act_Name, Act_Gender)<br>DIRECTOR(Dir_id, Dir_Name, Dir_Phone)<br>MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)<br>MOVIE_CAST(Act_id, Mov_id, Role)<br>RATING(Mov_id, Rev_Stars)<br>Write SQL queries to<br>1. List the titles of all movies directed by ‘Hitchcock’.<br>2. Find the movie names where one or more actors acted in two or more movies.<br>3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation).<br>4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.<br>5. Update rating of all movies directed by ‘Steven Spielberg’ to 5.<br>Reference:<br>https://www.youtube.com/watch?v=hSiCUNVKJAo<br>https://www.youtube.com/watch?v=IqQhPIJP64k |
| 4 | Aim: Introduce concepts of PLSQL and usage on the table.<br>Program: Consider the schema for College Database:<br>STUDENT(USN, SName, Address, Phone, Gender)<br>SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID)<br>COURSE(Subcode, Title, Sem, Credits)<br>IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)<br>Write SQL queries to<br>1. List all the student details studying in fourth semester ‘C’ section.<br>2. Compute the total number of male and female students in each semester and in each section.<br>3. Create a view of Test1 marks of student USN ‘1BI15CS101’ in all Courses.<br>4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.<br>5. Categorize students based on the following criterion:<br>If FinalIA = 17 to 20 then CAT = ‘Outstanding’<br>If FinalIA = 12 to 16 then CAT = ‘Average’<br>If FinalIA< 12 then CAT = ‘Weak’<br>Give these details only for 8th semester A, B, and C section students.<br>Reference:<br>https://www.youtube.com/watch?v=horURQewW9c<br>https://www.youtube.com/watch?v=P7-wKbKrAhk |
| 5 | Aim: Demonstrate the core concepts on table like procedure and trigger queries and also rank() function.<br>Program: Consider the schema for Voter Database:<br>CONSTITUENCY(cons_id, csname, csstate, no_of_voters)<br>PARTY(pid, pname, psymbol)<br>CANDIDATES(cand_id, phone_no, age, state, name, pid)<br>CONTEST(cons_id, cand_id) |

| | |
|---|---|
| | VOTER(vid, vname, vage, vaddr, cons_id, cand_id)<br>Write SQL queries to<br>1. List the details of the candidates who are contesting from more than one constituency which are belongs to different states.<br>2. Display the state name having maximum number of constituencies.<br>3. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg".<br>4. Display the constituency name, state and number of voters in each state in descending order using rank() function<br>5. Create a TRIGGER to UPDATE the count of "Number_of_voters" of the respective constituency in "CONSTITUENCY" table, AFTER inserting a tuple into the "VOTERS" table.<br>Reference:<br>https://www.youtube.com/watch?v=MSbzErdcb6g<br>https://www.youtube.com/watch?v=QFj-hZi8MKk |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata Mcgraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

**E-Resources:**
- https://www.youtube.com/watch?v=wOD02sezmX8
- https://www.youtube.com/watch?v=hIGoQC332VM
- https://www.youtube.com/watch?v=NNpFHQI_GT0
- https://www.youtube.com/watch?v=EGEwkad_IlA
- https://www.youtube.com/watch?v=t5hsV9IC1rU

## Semester: IV

## Course Name: ANALYSIS AND DESIGN OF ALGORITHMS

| | | | |
|---|---|---|---|
| Course Code | 22CS44 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction:**
Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithm, Mathematical Analysis of Recursive Algorithms.

**8 Hours**

**Module - 2**

**Brute Force and Exhaustive Search:** Selection Sort and Bubble Sort, Exhaustive Search.
**Decrease-and-Conquer:** Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decrease by- a-Constant-Factor Algorithms: Binary Search, Variable-Size-Decrease Algorithm: Euclids Algorithm

**8 Hours**

**Module – 3**

**Divide-and-Conquer:** Recurrence equation for divide and conquer, Master Theorem, Finding the maximum and minimum, Mergesort, Quicksort, Binary Search, Strassen's Matrix Multiplication.
**Transform-and-Conquer:** Presorting, Heaps and Heapsort, Problem Reduction Computing the Least Common Multiple.

**8 Hours**

**Module – 4**

**Greedy Method:** General method, Knapsack Problem, Job sequencing with deadlines, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm
**Dynamic Programming:** The Knapsack Problem, Warshall's and Floyd's Algorithms. Bellman-Ford Algorithm, Travelling Sales Person problem.

**8 Hours**

**Module – 5**

**Backtracking:** *n*-Queens Problem, Subset-Sum Problem, Graph coloring, Hamiltonian cycles.
**Branch-and-Bound:** Knapsack Problem, Traveling Salesman Problem, Job Assignment Problem.
**NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to the Design and Analysis of Algorithms | Anany Levitin | Pearson | 2nd Edition, 2009 |
| 2 | Computer Algorithms/C++ | Ellis Horowitz, Satraj Sahni and Rajasekaran | Universities Press | 2nd Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein | PHI | 3rd Edition, 2009 |

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|---|---|---|---|---|
| 2 | Design and Analysis of Algorithms | S. Sridhar | Oxford, Higher Education | 2014 |

## Semester: IV

## Course Name: ALGORITHMS LAB

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|---|---|---|---|
| Course Code | 22CSL45 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 03 |

**List of Experiments:**

**Identify the functional requirements, then Design and Develop solutions to the following list of problems using JAVA programming language.**

| SN | Experiments |
|---|---|
| 1 | a. Create a Java class called Student with the following details as variables within it.<br>(i) USN<br>(ii) Name<br>(iii) Programme<br>(iv) Phone<br>Write a Java program to create n Student objects and print the USN, Name, Programme, and Phone of these objects with suitable headings. |
| | b. Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working. |
| 2 | a. Design a superclass called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories. |
| | b. Write a Java class called Customer to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as "/". |
| 3 | Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero. |
| 4 | Sort a given set of N integer elements using Selection Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort. |
| 5 | Sort a given set of N integer elements using Insertion Sort technique and compute its time taken. |
| 6 | Implement Topological Sorting using DFS based method |
| 7 | Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case. Compare the priori and posteriori analysis of an algorithm. |
| 8 | Sort a given set of N integer elements using Merge Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort. Compare the priori and posteriori analysis of an algorithm |
| 9 | Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm |
| 10 | Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskals algorithm |
| 11 | From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java. |
| 12 | a)Implement All-Pairs Shortest Paths problem using Floyd's algorithm b) Find transitive closure of a given graph using Warshalls Algorithm |
| 13 | Implement in Java, the 0/1 Knapsack problem using Dynamic Programming method |
| 14 | Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance does not have a solution. |
| 15 | Implement "N-Queens problem" using Backtracking. |

**Semester: IV**

**Course Name**: **SYSTEM SOFTWARE**

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|---|---|---|---|
| **Course Code** | **22CS461** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **3** |
| **Total Hours of Pedagogy** | **40** | **Total Marks** | **100** |

**Pre-requisites:**

1. Basic Computer organization and architecture
2. Basic concepts of Operating System
3. Good programming skills in C and data structures

**Course objectives:**

1. Distinguish between system software and application software
2. Categorize the instruction formats and addressing modes of SIC and SIC/XE machine.
3. Write the object code for SIC and SIC/XE machine programs
4. List the steps involved to design a Bootstrap loader
5. Apply regular expressions to develop programs using LEX and YACC tools.

| Module – 1 |
|---|
| Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples. Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.<br>Text book 1: Chapter 1: 1.1,1.2,1.3, Chapter2: 2.1-2.2.<br>8 Hours |
| Teaching-Learning Process: Chalk and Board for numerical, Power point Presentation |
| Module – 2 |
| Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations – 1 Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.<br>Text book 1: Chapter2: 2.3-2.4.<br>8 Hours |

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| Teaching-Learning Process: Chalk and Board for numerical, Power point Presentation |
| Module – 3 |
| Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.<br>Text book 1 : Chapter 3: 3.1 -3.4<br>8 Hours |
| Module – 4 |
| Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.<br>Text book 1 : Chapter 4: 4.1 -4.4<br>8 Hours |
| Teaching-Learning Process: Chalk and Board for numerical, Power point Presentation |
| Module – 5 |
| Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running 43 LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.<br>Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.<br>Textbook 2: Chapter – 1, Chapter – 2, Chapter – 3<br>8 Hours |
| Teaching-Learning Process: Chalk and Board for numerical, Power point Presentation |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | | **Textbooks** | | |
| 1 | System Software | Leland L.Beck D Manjula | Pearson Education | 3rd Ed, 2012 |

| | | | | |
|---|---|---|---|---|
| 2 | Lex and Yacc | John R. Levine, Tony Mason and Doug Brown | O'Reilly | 2012 |
| | | | | |
| **Reference Books** | | | | |
| 1 | System Programming and Operating Systems | D.M. Dhamdhere, | Tata McGraw - Hill | 3rd Ed, 2013. |
| 2 | Systems programming | Srimanta Pal | Oxford university press | 2016 |

**Semester: IV**

Course Name: **OBJECT ORIENTED PROGRAMMING WITH PYTHON**

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|---|---|---|---|
| Course Code | **22CS462** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 |

**Pre-requisites:**

- Basic Knowledge of Programming
- Basic Knowledge of MS word, Excel and PDF

**Course objectives:**

1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples and dictionaries.
3. Demonstrate the use of built-in functions of file system.
4. Implement the Object Oriented Programming concepts in Python.
5. Appraise the need for working with various documents like Excel, PDF, Word and Others.

**Module – 1**

**Python Basics**, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending aProgram Early with sys.exit(), **Functions,** def Statements with Parameters, Return Valuesand return Statements,The None Value, Keyword Arguments and print(), Local and GlobalScope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Textbook 1: Chapters 1 – 3** **8 Hours**

**Module - 2**

**Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings,Useful String Methods

**Textbook 1: Chapters 4 – 6** **8 Hours**

## Module – 3

**Reading and Writing Files,** Files and File Paths, The os. path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat() Function, Project: Generating Random Quiz Files, Project: Multi clipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE"s Debugger.

**Textbook 1: Chapters 8 – 10** **8 Hours**

## Module – 4

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Textbook 2: Chapters 15 – 18** **8 Hours**

## Module – 5

**Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module

**Textbook 1: Chapters 12 – 14** **8 Hours**

### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist", | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press /Taylor & Francis | 1st Edition,2018 |

**e-Resources:**

1. https://automatetheboringstuff.com
2. http://greenteapress.com/thinkpython2/thinkpython2.pdf)

**Semester: IV**

**Course Name**: **INTRODUCTION TO DATA ANALYTICS**

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|---|---|---|---|
| **Course Code** | 22CS463 | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | 3:0:0 | **SEE Marks** | **50** |
| **Credits** | 03 | **Exam Hours** | **3** |
| **Total Hours of Pedagogy** | 40 | **Total Marks** | **100** |

**Pre-requisites:**

- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**

1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1**

| | |
|---|---|
| Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain. Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications. **8 Hours** | |
| **Teaching-Learning Process:** | Chalk and Board, Presentation |

**Module - 2**

| | |
|---|---|
| Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market. **8 Hours** | |
| **Teaching-Learning Process:** | Chalk and Board, Blended Learning, Presentation |

**Module – 3**

| | |
|---|---|
| Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI. **8 Hours** | |
| **Teaching-Learning Process:** | Chalk and Board, Presentation |

**Module – 4**

| | |
|---|---|
| Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram. **8 Hours** | |
| **Teaching-Learning Process:** | Chalk and Board, Presentation |

**Module – 5**

| | |
|---|---|
| Introduction, decision tree problem, decision tree construction, decision tree algorithms. **Advanced data visualization-** structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices. **8 Hours** | |
| **Teaching-Learning Process:** | Chalk and Board, Presentation |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | | **Textbooks** | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools,and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: IV**

Course Name: **Data Wrangling [For Data Science]**

| | | | |
|---|---|---|---|
| Course Code | 22CD42 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 60 |
| Total Hours of Pedagogy | 40+20 | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3hrs |

**Pre-requisites:** Basic Programming Knowledge, Python Programming

**Course objectives:**

Course objectives:
1. Understanding different data sources (databases, spreadsheets, APIs, etc.) and formats (CSV, JSON, XML, etc.) to gather data from various sources.
2. Identify and handle missing values, outliers, and inconsistencies in data and using different methods to imputation, data validation, and dealing with noisy data.
3. Introduce methods to reshape and restructure data to suit the analysis needs using the techniques like pivoting, melting, and aggregating data are typically covered.
4.Provide strategies to handle categorical variables, including encoding, one-hot encoding, and creating categorical hierarchies.
5. Explore and visualize data to identify trends, patterns, and relationships using libraries like Matplotlib, Seaborn, or Plotly

**Module – 1**

**INTRODUCTION TO DATA WRANGLING**
What Is Data Wrangling? - Importance of Data Wrangling -How is Data Wrangling performed? - Tasks of Data Wrangling-Data Wrangling Tools-Introduction to Python-Python Basics-Data Meant to Be Read by Machines-CSV Data-JSON Data-XML Data.
**TB1: Chapter 1,2and 3**

**8 Hours**

**Module - 2**

**WORKING WITH EXCEL FILES AND PDFS**
Installing Python Packages-Parsing Excel Files-Parsing Excel Files -Getting Started with Parsing-PDFs and Problem Solving in Python-Programmatic Approaches to PDF Parsing-Converting PDF to Text-Parsing PDFs Using pdf miner-Acquiring and Storing Data-Databases: A Brief Introduction-Relational Databases: MySQL and PostgreSQL-Non-Relational Databases: NoSQL-When to Use a Simple File-Alternative Data Storage.
**TB1: Chapter 4,5and 6**

**8 Hours**

**Module – 3**

**DATA CLEANUP**
Why Clean Data?- Data Cleanup Basics-Identifying Values for Data Cleanup-Formatting Data-Finding Outliers and Bad Data-Finding Duplicates-Fuzzy Matching-RegEx

Matching-Normalizing and Standardizing the Data-Saving the Data-Determining suitable Data Cleanup-Scripting the Cleanup Testing with New Data
**TB1: Chapter 7 and 8**

**8 Hours**

**Module – 4**

**DATA EXPLORATION**
Exploring Data-Importing Data-Exploring Table Functions-Joining Numerous Datasets-Identifying Correlations-Identifying Outliers-Creating Groupings-Analyzing Data-Separating and Focusing the Data Presenting.
**TB1: Chapter 9**

**8 Hours**

**Module – 5**

**DATA ANALYSIS**
Data-Visualizing the Data-Charts-Time-Related Data-Maps-Interactives-Words-Images, Video, and Illustrations-Presentation Tools-Publishing the Data-Open-Source Platforms.
**TB1: Chapter 10**

**8 Hours**

**PRACTICAL COMPONENT** **20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Write a Python script to read each row from a given csv file and print a list of strings |
| 2 | Write a Python program to read a given CSV file as a dictionary. |
| 3 | Write a Python program to convert Python dictionary object (sort by key) to JSON data. Print the object members with indent level 4 |
| 4 | Write the python script to Read the XML file |
| 5 | Write a Pandas program to import excel data (child labor and child marriage data.xlsx ) into a Pandas data frame and process the following<br>a. Get the data types of the given excel data<br>b. Display the last ten rows.<br>c. Insert a column in the sixth position of the said excel sheet and fill it with NaN values |
| 6 | Develop the Python Shell Script to do the basic data cleanup on child labour and child marriage data.xlsx<br>a. Check duplicates and missing data<br>b. Eliminate Mismatches<br>c. Cleans line breaks, spaces, and special characters |
| 7 | Extract the Table from the child labor and child marriage data.xlsx using pdfables library |
| 8 | Write the python script to Map the Child Labor Worldwide using pygal. |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Wrangling with Python | Jacqueline Kazil & Katharine Jarmul," Inc, | O'Reilly Media, | 2016 |
| **Reference Books** | | | | |
| 1 | Data Wrangling with Python: Creating actionable data from raw sources | Dr. Tirthajyoti Sarkar, Shubhadeep | Packt Publishing Ltd | 2019. |
| 2 | Hands-On Data Analysis with Pandas | Stefanie Molin | Packt Publishing Ltd | 2019. |
| 3 | Practical Data Wrangling | Allan Visochek | Packt Publishing Ltd | 2017 |
| | | | | |

**e-Resources:**

1. http://www.gbv.de/dms/ilmenau/toc/827365454.PDF

**MOOC**

1. https://www.udemy.com/course/data-wrangling-with-python/
2. http://www.openculture.com/free-online-data-science-courses
3. https://www.classcentral.com/course/dataanalysiswithpython-11177

**Semester: IV**

**Course Name**: **PRINCIPLES OF ARTIFICIAL INTELLIGENCE**

| | | | |
|---|---|---|---|
| **Course Code** | **22AI42** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:0** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **3** |
| **Total Hours of Pedagogy** | **40** | **Total Marks** | **100** |

**Pre-requisites:**

- **Knowledge of a programming language and Mathematical knowledge.**

**Course objectives:**

1. Gain a historical perspective of AI and its foundations
2. Become familiar with basic principles of AI toward problem solving
3. Get to know approaches of inference, perception, Uncertain Knowledge and Reasoning.
4. Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
5. Experiment with a machine learning model for simulation and analysis.

**Module – 1**

**Introduction:** What is AI? Foundations and History of AI
**Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

**Text book 1:** Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4

**8 Hours**

**Teaching-Learning Process:** Chalk and board, Active Learning – Oral presentations

**Module - 2**

**Problem-solving:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

**Text book 1**: Chapter 3- 3.1, 3.2, 3.3, 3.4

**8 Hours**

**Teaching-Learning Process:** Chalk and board, Active Learning – Oral presentations

**Module – 3**

**Informed Search Strategies:** Heuristic functions, Greedy best first search, A*search. Heuristic Functions
**Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

**Text book 1**: Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5

**8 Hours**

**Teaching-Learning Process:** Chalk and board, Active Learning – Oral presentations

**Module – 4**

| |
|---|
| **First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.<br>**Inference in First Order Logic:**Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution<br><br>**Text book 1**: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5<br>**8 Hours** |
| **Teaching-Learning Process:** Chalk and board, Active Learning – Oral presentations |

**Module – 5**

| |
|---|
| **Uncertain Knowledge and Reasoning: Quantifying Uncertainty:** Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited<br><br>**Text Book 1**: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6<br>**8 Hours** |
| **Teaching-Learning Process:** Chalk and Board, Power Point Presentation |

**<u>List of Experiments:</u>**

**Part A**

**Practicing Problems in Python (Students can be encouraged to practice good number of practice problems, some practice problems are listed here)**

1. (a) Write a python program to print the multiplication table for the given number
   (b) Write a python program to check whether the given number is prime or not?
   (c) Write a python program to find factorial of the given number?
2. (a) Write a python program to implement List operations (Nested List, Length, Concatenation,
   Membership, Iteration, Indexing and Slicing)
   (b) Write a python program to implement List methods (Add, Append, and Extend& Delete).
3. Write a python program to implement simple Chabot with minimum 10 conversations
4. Write a python program to Illustrate Different Set Operations
5. (a)Write a python program to implement a function that counts the number of times a string (s1) occurs in another string(s2)
   (b)Write a program to illustrate Dictionary operations ([], in, traversal)and methods: keys (),values(),items()

**Part B**

**AI Problems to be implemented in Python**

1 Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2 Implement and Demonstrate Best First Search Algorithm on any AI problem
3 Implement AO* Search algorithm.
4 Solve 8-Queens Problem with suitable assumptions
5 Implementation of TSP using heuristic approach
6 Implementation of the problem solving strategies: either using Forward Chaining or

Backward Chaining
7 Implement resolution principle on FOPL related problems
8 Implement any Game and demonstrate the Game playing strategies

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | | **Textbooks** | | |
| 1 | Artificial Intelligence | Stuart J. Russell and Peter Norvig | Pearson | 3rd Edition,2015 |
| | | **Reference Books** | | |
| 1 | Introduction to Machine Learning | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3RD Edition 2013 |
| 2 | Artificial Intelligence Structure and strategies for complex | George F Lugar | Pearson Education | 5th Edition 2011 |

# Scheme of Teaching and Evaluation for

# B.E – V & VI Semester

# Computer Science & Engg.

# (2021 Scheme)

**Scheme of Teaching and Evaluation for B.E Program**

# Computer Science & Engineering

**With effect from the Academic Year 2021-22**
**Total Credits for B.E.: 160**
**Credits Distribution as per NEP 2020**

| SEM | HS | BS | ES | PC | PE | AEC | OE | PW | INT | SE | UHV | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | **20** |
| **2** | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | **20** |
| **3** | 1 | 3 | - | 12 | - | 2 | - | - | - | - | - | **18** |
| **4** | 1 | 3 | - | 12 | - | 3 | - | - | 2 | - | 1 | **22** |
| **5** | 1 | - | - | 11 | 3 | 2 | 3 | - | - | - | - | **20** |
| **6** | 3 | - | - | 8 | 3 | 1 | 3 | 2 | 2 | - | - | **22** |
| **7** | - | - | - | 7 | 3 | - | 3 | 8 | - | - | - | **21** |
| **8** | - | - | - | 3 | - | - | - | - | 13 | 1 | - | **17** |
| **TOTAL** | **10** | **20** | **20** | **53** | **9** | **10** | **9** | **10** | **17** | **1** | **1** | **160** |

| SN | Course Area | Credit Distribution |
|---|---|---|
| **1.** | Humanities Social Sciences including Management (HS) | 10 |
| **2.** | Basic Sciences (BS) | 20 |
| **3.** | Engineering Sciences (ES) | 20 |
| **4.** | Professional Core (PC) | 53 |
| **5.** | Professional Electives (PE) | 09 |
| **6.** | Ability Enhancement Course(AEC) | 10 |
| **7.** | Open Electives | 09 |
| **8.** | Project Work(Mini/Major) | 10 |
| **9.** | Internship(INT) | 17 |
| **10.** | Seminar (SE) | 01 |
| **11.** | Universal Human Values(UHV) | 01 |
| **12.** | Mandatory Non-Credit Course (MNC) | - |
| | **Total** | **160** |

**The above is based on the VTU guidelines and the AICTE Model Curriculum**

# Semester: V

| SN | Course | Course Code | Course Title | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours /Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | PCC | 21CS51 | Automata Theory & Compiler Design | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21CS52 | System Software and Operating System | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CS53 / 21AI53 | Database Management System | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CS54X / 21AI54X | Professional Elective – 1 | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CS55X /21AI55X | Open Elective - 1 | Other departments offering the course | Other departments offering the course | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CSL56 / 21AIL56 | DBMS Lab with Mini Project | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21CSL57 | System Software & Operating System Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | AEC | 21ADA580 | Advanced Aptitude | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 09 | AEC | 21CS58X / 21AI58X | AEC | Concerned Department | CSE | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 10 | HS | 21ENV59 | Environmental Studies | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| **Total** | | | | | | | | | **20** | | **500** | **500** | 1000 |

| Ability Enhancement Course | | |
|---|---|---|
| 01 | 21CS581/ 21AI581 | C# and .Net Framework |
| 02 | 21CS582 / 21AI582 | PYTHON Programming |
| | | |
| **Professional Elective – 1** | | |
| 01 | 21CS541 / 21AI541 | Agile Technology |
| 02 | 21CS542 / 21AI542 | Introduction to Data Analytics |
| 03 | 21CS543 / 21AI543 | Cyber Security |
| | | |
| **Open Elective -1** | | |
| 01 | 21CS551 | Introduction to Data Structures |
| 02 | 21CS552 | Introduction to Database Management Systems |
| 03 | 21CS553 | Introduction to PYTHON Programming |
| 04 | 21CS554 | Introduction to Operating System |

# Semester: VI

| SN | Course | Course Code | Course Title | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours /Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | HS | 21CS61 / 21AI61 | Software Project Management | Humanities / Concerned Department | Humanities / CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21CS62 | Computer Networks | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CS63 | Artificial Intelligence & Machine Learning | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CS64X/ 21AI64X | Professional Elective – 2 | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CS65X /21AI65X | Open Elective - 2 | Other departments offering the course | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CSL66 | Computer Networks Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21CSL67 | AI&ML Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | PW | 21MN68 | Mini Project | Concerned Department | CSE | Two contact hours /week for interaction between the faculty and students | | | 2 | 3 | 50 | 50 | 100 |
| 09 | AEC | 21CS69X /21AI69X | | Concerned Department | CSE | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 10 | INT | 21INT691 | Summer Internship-II | Completed during the intervening period of IV and V semesters. | | | | | 2 | --- | 100 | - | 100 |
| **Total** | | | | | | | | | **22** | | **550** | **450** | **1000** |

| | | |
|---|---|---|
| **Ability Enhancement Course** | | |
| 01 | 21CS69A | Computer Graphics using Open GL |
| 02 | 21CS69B | Mobile Application Development |
| 03 | 21CS69C | Robotic Process Automation |
| **Professional Elective – 2** | | |
| 01 | 21CS641 / 21AI641 | Cloud Computing |
| 02 | 21CS642 / 21AI642 | Block Chain Technology |
| 03 | 21CS643 / 21AI643 | Natural Language Processing |
| | | |
| 01 | 21CS651 | Programming in JAVA |
| 02 | 21CS652 | Introduction to Data Analytics |
| 03 | 21CS653 | Introduction to Artificial Intelligence & Machine Learning |
| 04 | 21CS654 | Introduction to Cyber Security |

## Internship – II (21INT691):

All the students admitted to engineering programmes shall have to undergo a mandatory internship-II of 04 weeks during the intervening vacation of IV and V semesters.

All the students **TAKING FAST TRACK /SUPPLEMENTARY SEMESTER** shall have to undergo a mandatory internship-II of 04 weeks during the intervening period of V and VI semesters. Internship-II shall include Innovation/ Entrepreneurship / Societal based Internship. A Viva-voce examination (Presentation followed by question-answer session) shall be conducted during VI semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examinations after satisfying the internship requirements The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.

# Scheme of Teaching and Evaluation for

# B.E – V Semester

# Computer Science & Engg.

# (2021 Scheme)

## Semester: V

## Course Name: AUTOMATA THEORY AND COMPILER DESIGN

| | | | |
|---|---|---|---|
| Course Code | **21CS51** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
Students must have a knowledge of basic concepts of set theory and any one of a programming Language

**Course objectives:**
1. Explain the basic concepts of Automata Theory and Compiler Design and design Finite Automata for given Regular Languages
2. Illustrate the concept of Regular expressions and explain the entire process of identifying lexemes and generating tokens from a given Source program
3. Demonstrate the concept of Context Free Grammars and Parse the given input string using Top-down Parser
4. Describe the working of PDA and to illustrate the process of Parsing of the given input string using Bottom-up Parser
5. Explain the process design of Turing Machine and Demonstrate the Concepts of Syntax Directed Translation, Intermediate Code Generation, Code Generation

**Module – 1** **08 Hours**

**Introduction to Automata Theory:** Central Concepts of Automata theory, Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA) ,Epsilon- NFA, NFA to DFA Conversion, Minimization of DFA
**Introduction to Compiler Design**: Language Processors, Phases of Compiler

**Module - 2** **08 Hours**

Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Proving Languages Not to Be Regular
Lexical Analysis Phase of compiler Design: Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens.

**Module – 3** **08 Hours**

**Context Free Grammars:** Definition and designing CFGs, Derivations Using a Grammar, Parse Trees, Ambiguity and Elimination of Ambiguity, Elimination of Left Recursion, Left Factoring.
Syntax Analysis: part-1: Role of Parser , Top-Down Parsing-Recursive Descent Parsing, FIRST and FOLLOW, Predictive LL(1) Parsing,

**Module – 4** **08 Hours**

Push Down Automata: Introduction, Formal Definition, Graphical notation and Instantaneous Descriptions of PDA, The Languages of a PDA-acceptance by Final state and empty stack.

Syntax Analysis Phase of Compilers: Part-2: Bottom-up Parsing, Introduction to LR Parsing: SLR Parsing-Items and the LR(0) Automaton , Constructing SLR Parsing Tables, SLR Parsing Algorithm

**Module – 5** **08 Hours**

**Introduction to Turing Machine:** Problems that Computers Cannot Solve, The Turing machine, problems, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine
**Other Phases of Compilers:** Syntax Directed Translation- Syntax-Directed Definitions, Annotated Parse tree, Evaluation Orders for SDD's. Intermediate-Code Generation- Variants of Syntax Trees, Three-Address Code. Code Generation- Issues in the Design of a Code Generator

**Course Outcomes:**

**At the end of the course the student will be able to:**

1. Design Finite Automata for given Regular Languages
2. Demonstrate the process of generating stream of tokens from a given source program
3. Design Context Free Grammars, Predictive Parsing table and Parse the given input string using Predictive LL(1) Parser
4. Construct Push Down Automata, SLR Parsing table, Parse the given input string using SLR Parser
5. Design Turing Machine and explain Un-decidability, Syntax Directed translation, Intermediate code Generation and code Generation

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Automata Theory, Languages and Computation | John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman | Pearson | Third Edition |
| 2 | Compilers- Principles, Techniques and Tools | Alfred V.Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman | Pearson | Second Edition |
| **Reference Books** | | | | |
| 1 | Automata, Computability and Complexity | Elain Rich | Pearson Education | First Edition |
| 2 | Compiler Design | K Muneeswaran | Oxford University Press | First edition |

## Semester: V
## Course Name: SYSTEM SOFTWARE AND OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **21CS52** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:** The students should have the knowledge of:
1. Basics of computer system and its applications
2. Basics of computer organization

**Course objectives:**
1. To introduce Operating System, OS responsibilities, and OS services.
2. To demonstrate process concept, scheduling techniques, and deadlock condition.
3. To discuss memory management and virtual memory management concepts.
4. To explain about system software, application software and classify the instruction formats, addressing modes of SIC and SIC/XE machine.
5. To illustrate the object code for SIC and SIC/XE machine programs.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer system organization; Computer system architecture; Operating system structure; Operating system operations; Process management; Memory management; Storage management.
**Operating System Services:** User-Operating system interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating system structure; Virtual machines.

**Module - 2** **08 Hours**

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication
**Process Scheduling**: Basic concepts; Scheduling criteria; Scheduling algorithms.
**Deadlocks:** Introduction to Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Module – 3** **08 Hours**

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**Module – 4** **08 Hours**

**Introduction to System Software**: Machine architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options.

**Module – 5** **08 Hours**

**Loaders and Linkers:** Basic loader functions, Machine dependent loader features, Machine independent loader features, Loader design options.

**Course Outcomes:**

At the end of the course the students will be able to:

1. Analyze the working of operating system, its responsibilities and services.
2. Illustrate the scheduling techniques and deadlock conditions of multiple processes.
3. Differentiate between memory and virtual memory with the help of various strategies like swapping, segmentation, and paging.
4. Distinguish between system software and application software.
5. Classify the different instruction formats and addressing modes of SIC and SIC/XE machine.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | System Software: An Introduction To Systems Programming | Leland L Beck & D Manjula | Pearson Education | Third 2012 |
| 2 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D. M. Dhamdhere | McGraw- Hill | 3rd Ed, 2013. |

## Semester: V
## Course Name: DATABASE MANAGEMENT SYSTEMS

| | | | |
|---|---|---|---|
| Course Code | **21CS53** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.
**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

**Module - 2** **08 Hours**

**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping
**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Module – 3** **08 Hours**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.
**Advanced Aggregation Features:** Ranking – dense rank, partition by
**Application Development:** Accessing SQL From a Programming Language, An introduction to JDBC, ODBC, Embedded SQL, SQLJ, Stored procedures

**Module – 4** **08 Hours**

**Normalization: Database Design Theory –** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.
**Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

**Module – 5** **08 Hours**

| |
|---|
| **Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.<br>**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. |

**Course Outcomes:**

1. Demonstrate the basic elements of a relational database management system.
2. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
3. Create, populate and manage relational databases in SQL.
4. Extend normalization for the development of application software.
5. Analyze and implement transaction processing, concurrency control, and database recovery protocols in database.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata Mcgraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

## Semester: V
## Course Name: AGILE TECHNOLOGY

| | | | |
|---|---|---|---|
| Course Code | **21CS541 / 21AI541** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Knowledge of Software Engineering and Programming Language**

**Course objectives:**
1. Explain the fundamental concepts of agile software engineering
2. Demonstrate the need to apply the principles of XP life cycle.
3. Evaluate various functionalities of XP programming.
4. Demonstrate concepts to Eliminate Waste

**Module – 1** **08 Hours**

**Agile:** Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **Agile Methods**, Don't Make Your Own Method, The Road to Mastery, Find a Mentor

**Module - 2** **08 Hours**

**Understanding XP:** The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us, Go!, Assess Your Agility

**Module – 3** **08 Hours**

**Practicing XP: Thinking:** Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives,
**Collaborating:** Trust, Sit Together, Real Customer, Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting,
**Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.
**Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

**Module – 4** **08 Hours**

**Mastering Agility: Values and Principles:** Commonalities, About Values, Principles, and Practices, Further Reading,
**Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules,
**Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People,
**Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

**Module – 5** **08 Hours**

**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence :**Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

**Course Outcomes:**

1. Interpret the concept of agile software engineering and its advantages in software development
2. Outline XP Lifecycle, XP Concepts, Adopting XP
3. Apply the principles of XP for real time examples.
4. Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
5. Demonstrate concepts to Eliminate Waste

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The Art of Agile Development | James shore, Chromatic, | O'Reilly | 2007 |
| **Reference Books** | | | | |
| 1 | Agile Software Development, Principles, Patterns, and Practices | Robert C. Martin | Prentice Hall | 1st edition, 2002 |
| 2 | Agile and Iterative Development A Manger's Guide | Craig Larman | Pearson Education | First Edition, India, 2004 |

## Semester: V
## Course Name: INTRODUCTION TO DATA ANALYTICS

| | | | |
|---|---|---|---|
| Course Code | 21CS542 / 21AI542 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Credits | 03 | Exam Hours | 03 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |

**Pre-Requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module - 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
**Advanced data visualization-** structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

**At the end of the course the student will be able to:**

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools,and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

## Semester: V
## Course Name: CYBER SECURITY

| | | | |
|---|---|---|---|
| Course Code | **21CS543 / 21AI543** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**The students should have the knowledge of:**
- Awareness about the loopholes/drawbacks of the advanced technologies on which the society is dependent.
- Awareness about the crimes being done through technology.

**Course objectives:**
1. To familiarize the cybercrime terminologies and perspectives.
2. To illustrate the phases of cybercrime plan and different types of cybercrimes.
3. To gain the knowledge about the tools and methods used by the criminals.
4. To reveal the techniques used in phishing and identity theft.
5. To emphasize the necessary of computer and cyber forensics.

**Module – 1** **08 Hours**

**Introduction to Cybercrime:**
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**Module - 2** **08 Hours**

**Cyber Offenses:**
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

**Module – 3** **08 Hours**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

**Module – 4** **08 Hours**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

**Module – 5** **08 Hours**

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**Course Outcomes:**

1. Identify the various terminologies being used in cybercrime.
2. Categorize the types of cybercrimes.
3. Illustrate the tools and methods used by criminals for cybercrime.
4. Compare the various techniques used in phishing and identity theft.
5. Utilize various cyber security techniques including cyber forensics.

**Suggested Learning Resources:**

**Text Books:**

Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

**Reference Books:**

Neil Daswani, Moudy Elbayadi Big Breaches: “Cyber-security Lessons for Everyone”, Feb 2021

**Semester: V**

**Course Name: DATABASE MANAGEMENT SYSTEM LAB WITH MINI PROJECT**

| | | | |
|---|---|---|---|
| Course Code | **21CSL56 / 21AIL56** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Create a database using fundamental SQL commands.
2. Analyze the database concepts to design a schema diagram.
3. Retrieving the data from the database.
4. Performing database operations in a procedural manner using SQL.
5. Design and develop applications like Employee, Movie management systems etc.

## List of Experiments:
## Part A

**Identify the functional requirements, then Design Develop solutions to the problems related to:**

1. **Aim: Discuss the various concepts on constraints and update operations.**
   Program: Consider the following schema for Order Database:
   SALESMAN(Salesman_id, Name, City, Commission)
   CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
   ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

   Write SQL queries to
   1. Count the customers with grades above Bangalore's average.
   2. Find the name and numbers of all salesman who had more than one customer.
   3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
   4. Create a view that finds the salesman who has the customer with the highest order of a day.
   5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

   **Reference:**
   https://www.youtube.com/watch?v=AA-KL1jbMeY
   https://www.youtube.com/watch?v=7S_tz1z_5bA

2. **Aim: Demonstrating creation of tables, applying the nested query concepts.**
   Program Consider the following schema for a Cricket Database:
   TEAM( tid, tname, coach, captain_pid , city)
   PLAYER( pid, pname, age, tid)
   STADIUM(sid, sname, pincode, city)
   MATCH(mid, mdate, time, sid, team1_id, team2_id, winning_team_id, man_of_match, pid)

   Write SQL queries to
   1. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
   2. List the details of the stadium where the maximum number of matches were played.
   3. List the details of the player who is not a captain but got the man_of _match award at least in two matches.
   4. Display the Team details who won the maximum matches.
   5. Display the team name where all its won matches played in the same stadium.

**Reference:**
https://www.youtube.com/watch?v=lBpSMeQjNqQ
https://www.youtube.com/watch?v=_yog7h4BokQ

3. **Aim: Demonstrate the concepts of JOIN operations.**

Program: Consider the schema for Movie Database:
ACTOR(Act_id, Act_Name, Act_Gender)
DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)

Write SQL queries to
1. List the titles of all movies directed by 'Hitchcock'.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'Steven Spielberg' to 5.

**Reference:**
https://www.youtube.com/watch?v=hSiCUNVKJAo
https://www.youtube.com/watch?v=IqQhPlJP64k

4. **Aim: Introduce concepts of PLSQL and usage on the table.**

Program: Consider the schema for College Database:
STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID)
COURSE(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to
1. List all the student details studying in fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
   If FinalIA = 17 to 20 then CAT = 'Outstanding'
   If FinalIA = 12 to 16 then CAT = 'Average'
   If FinalIA< 12 then CAT = 'Weak'

Give these details only for 8th semester A, B, and C section students.

**Reference:**
https://www.youtube.com/watch?v=horURQewW9c
https://www.youtube.com/watch?v=P7-wKbKrAhk

5. **Aim: Demonstrate the core concepts on table like procedure and trigger queries and also rank() function.**
   Program: Consider the schema for Voter Database:
   CONSTITUENCY(cons_id, csname, csstate, no_of_voters)
   PARTY(pid, pname, psymbol)
   CANDIDATES(cand_id, phone_no, age, state, name, pid)
   CONTEST(cons_id, cand_id)
   VOTER(vid, vname, vage, vaddr, cons_id, cand_id)

   Write SQL queries to
   1. List the details of the candidates who are contesting from more than one constituency which are belongs to different states.
   2. Display the state name having maximum number of constituencies.
   3. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg".
   4. Display the constituency name, state and number of voters in each state in descending order using rank() function
   5. Create a TRIGGER to UPDATE the count of "Number_of_voters" of the respective constituency in "CONSTITUENCY" table, AFTER inserting a tuple into the "VOTERS" table.

   **Reference:**
   https://www.youtube.com/watch?v=MSbzErdcb6g
   https://www.youtube.com/watch?v=QFj-hZi8MKk

## Part B

**Mini Project:** For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc. Demonstrate by using front-end tools with reports

**Course Outcomes:**
1. Apply fundamentals of SQL commands to construct a database.
2. Analyze and Design database schema for a given problem domain.
3. Design and implement various databases (Ex. Cricket, Movies etc.)
4. Evaluate nested queries for data manipulation.
5. Design, Develop and Evaluate mini project using modern tools(Like Oracle, MySQL, NetBeans, Eclipse, Apache Tomcat)

## Semester: V
## Course Name: SYSTEM SOFTWARE & OPERATING SYSTEM LAB

| | | | |
|---|---|---|---|
| Course Code | **21CSL57** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Explain the Lexical Analysis and Syntax Analysis phases of Compiler Design.
2. Demonstrate programs on Lexical and Syntax Analysis using LEX & YACC tools.
3. Compare different types of CPU scheduling algorithms used in operating system.
4. Demonstrate the deadlock handling algorithm.
5. Analyze page replacement algorithms for memory management.

## List of Experiments:
## Part A

**Identify the functional requirements, then Design Develop solutions to the problems related to:**

| | |
|---|---|
| **1.** | Write a LEX program to recognize valid arithmetic expression. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.<br>Write YACC program to evaluate arithmetic expression involving operators: +, -, *, and / |
| **2.** | Develop, Implement and Execute a program using YACC tool to recognize all strings ending with b preceded by n a's using the grammar an b (note: input n value) |
| **3.** | Design, develop and implement YACC/C program to construct Predictive / LL(1) Parsing Table for the grammar rules: A →aBa , B →bB \| ϵ. Use this table to parse the sentence: abba$ |
| **4.** | Design, develop and implement YACC/C program to demonstrate Shift Reduce Parsing technique for the grammar rules: E →E+T \| T, T →T*F \| F, F → (E) \| id and parse the sentence: id + id * id. |
| **5.** | Design, develop and implement a C/Java program to generate the machine code using ***Triples*** for the statement ***A = -B * (C +D)*** whose intermediate code in three-address form:<br>***T1 = -B***<br>***T2 = C + D***<br>***T3 = T1 + T2***<br>***A = T3*** |
| **6.** | Write a LEX program to eliminate ***comment lines*** in a ***C*** program and copy the resulting program into a separate file.<br>Write YACC program to recognize valid ***identifier, operators and keywords*** in the given text (*C program*) file. |

## Part B

| | |
|---|---|
| **7.** | Design, develop and implement program using any programming language to simulate the working of:<br>1) FCFS<br>2) SJF<br>3) RR<br>4) Priority scheduling algorithm. |
| **8.** | Implement a program using any programming language to demonstrate Banker's algorithm. Assume suitable input required. |
| **9.** | Design and develop a program using any programming language to implement page replacement Algorithms OPTIMAL and FIFO. Assume suitable input required to demonstrate the results. |

**Course Outcomes:**

The student will be able to:-

1. Analyze the programs lexically and syntactically using LEX and YACC tool.
2. Write a program to construct a Predictive parsing table, Shift Reducing parsing technique and machine code for a given grammar.
3. Compare different CPU scheduling techniques used in OS.
4. Design and develop the Banker's algorithm for avoiding deadlock state.
5. Apply the page replacement algorithms for the efficient management of memory.

## Semester: V
## Course Name: Advanced Aptitude

| | | | |
|---|---|---|---|
| Course Code | **21ADA580** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
1. Fundamentals of Mathematics
2. Basic knowledge of Reasoning

**Module – 1: Numerical Ability Based** **03 Hours**

Simplifications, Squares and Square Roots, Cubes and Cube roots, BODMAS Rule, LCM, HCF, Fractions and Decimals

**Module – 2: Percentage Based** **03 Hours**

Percentages, Profit and Loss, Discounts, Simple Interest and Compound Interest

**Module – 3: Time Based** **03 Hours**

Time and Work, Pipes and Cisterns, Time and Distance, Trains, Boats and Streams

**Module – 4: Ratio Based** **03 Hours**

Ratio-proportion, Partnership, Averages and Ages

**Module – 5: Logical and Analytical Based** **03 Hours**

Seating Arrangement, Series, Analogy, Odd man out and Blood Relations

**Course Outcomes:**

**At the end of course students will be able to**
1. Analyze and solve questions based on logical thinking and critical reasoning.
2. Analyze and solve quantitative aptitude problems
3. Solve aptitude problems using fast track techniques
4. Solve puzzle based questions
5. Analyze and solve problems on numerical computation and numerical estimation

## Semester: V
## Course Name: C# AND .NET FRAMEWORK

| | | | |
|---|---|---|---|
| Course Code | **21CS581 / 21AI581** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
**Any Object oriented programming**

**Course objectives:**
1. Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
2. Understand Object Oriented Programming concepts in C# programming language.
3. Interpret Interfaces and define custom interfaces for application.
4. Build custom collections and generics in C#
5. Construct events and query data using query expressions

**Module – 1** **03 Hours**

**Introducing Microsoft Visual C# and Microsoft Visual Studio 2015:** Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions

**Module - 2** **03 Hours**

**Understanding the C# object model:** Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays

**Module – 3** **03 Hours**

Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management

**Module – 4** **03 Hours**

**Defining Extensible Types with C#:** Implementing properties to access fields, Using indexers, Introducing generics, Using collections

**Module – 5** **03 Hours**

Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading

**Course Outcomes:**
1. Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
2. Demonstrate Object Oriented Programming concepts in C# programming language
3. Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
4. Illustrate the use of generics and collections in C#
5. Compose queries to query in-memory data and define own operator behavior

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Microsoft Visual C# Step by Step | John Sharp | PHI Learning Pvt. Ltd | 8th Edition, 2016 |
| **Reference Books** | | | | |
| 1 | C# 6 and .NET Core 1.0 | Christian Nagel | Wiley India Pvt Ltd | 1st Edition 2016 |
| 2 | Essential C# 6.0 | Mark Michaelis | Pearson Education India | 5th Edition, 2016 |
| 3 | Prof C# 5.0 and the .NET 4.5 Framework | Andrew Troelsen | Apress and Dreamtech Press | 6th Edition, 2012. |

## Semester: V
## Course Name: PYTHON PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **21CS582 / 21AI582** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
**Basic Knowledge of Programming**

**Course objectives:**
1. Interpret the basic syntax and semantics of several expressions and functions.
2. Demonstrate the concepts of Iterations and files applied in real world scenario
3. Illustrate the python programs using Strings and Dictionaries.
4. Extend the importance of object oriented programming in python.
5. Implement inheritance concepts to solve real world problems

**Module – 1** **03 Hours**

**Python Basics:** Variables, expressions and statements, Conditional execution, Functions

**Module - 2** **03 Hours**

**Iteration:** While statement, Infinite Loops, definite loops, Loop patterns
**Strings:** String traversal, String Slices, in operator, String methods Format operator
**Files:** Persistence, Opening, reading from text files, using try, except and open, writing to text files

**Module – 3** **03 Hours**

**Lists:** List Operations, slices, methods, lists and functions, list and strings, objects and value, Aliasing, List arguments
**Dictionaries:** Dictionary as a set of counters, Dictionaries and files, Looping and Dictionaries, Advanced text parsing

**Module – 4** **03 Hours**

**Tuples:** Comparing tuples, Tuple assignment, Dictionaries and tuples, Sequences, List comprehension
**Regular Expressions:** Character matching in regular expressions, extracting data using regular expressions, Combining searching and extracting, Escape character

**Module – 5** **03 Hours**

**Classes and objects:** Programmer-defined types, Attributes, Instances as return value, Objects are mutable, Copying
**Classes and functions:** Pure functions, modifiers, prototyping versus planning
**Classes and methods:** Object oriented features, init method, str method, operator overloading, type-based dispatch, polymorphism, Interface and implementation

**Course Outcomes:**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement python data structures to solve real world problems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Python for Everybody: Exploring Data Using Python 3 | Charles R. Severance | CreateSpace Independent Publishing Platform | 1st Edition, 2016 |
| 2 | Think Python: How to Think Like a Computer Scientist | Allen B. Downey | Green Tea Press | 2nd Edition, 2015 |
| **Reference Books** | | | | |
| 1 | Introduction to Computer Science Using Python | Charles Dierbach | CRC Press /Taylor & Francis | 1st Edition,2018 |
| 2 | Programming Python | Mark Lutz | O'Reilly Media | 4th Edition, 2011 |
| 3 | Core Python Applications Programming | Wesley J Chun | Pearson Education India | 3rd Edition, 2015 |

## Semester V
## Course Name: Environmental Studies

| | | | |
|---|---|---|---|
| Course Code | 21ENV59 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 02 |

**Pre-Requisites:**
**Water supply and treatment engineering.**

**Course objectives:**
1. Understand and evaluate the global scale of environmental problems
2. Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world

**Module – 1** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Ecosystems (Structure and Function):** Forest, Desert, Wetlands, Riverine, Oceanic and Lake. **Biodiversity:** Types, Threats and Conservation of biodiversity. Forest Wealth, and Deforestation. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Advances in Energy Systems (Merits, Demerits, Global Status and Applications):** Hydrogen, Solar, OTEC, Tidal and Wind. **Natural Resource Management (Concept and case-studies**): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts,)**: Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Global Environmental Concerns (Concept, policies and case-studies**): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.IS. & Remote Sensing. Environment Impact Assessment. Environmental Management Systems. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, you tube videos. |

**Course Outcomes:**

1. **Understand** the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale. Estimate runoff and develop unit hydrographs.
2. **Develop** critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. **Demonstrate** ecology knowledge of a complex relationship between biotic and a biotic component**.**
4. **Apply** their ecological knowledge to illustrate and graph a problem.
5. Describe the realities that managers face when dealing with complex issues.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**SEE:**

1. The question paper will have 100 questions. Each question is set for 01 marks.
2. The students have to answer 100 multiple choice questions.
3. The duration of the Examination is 02 hours.
4. The final marks will be scaled down to 50 marks.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | **Textbooks** | | | |
| 1 | Environmental Studies | S M Prakash | Pristine Publishing House, Mangalore | 3rd Edition, 2018 |
| 2 | **Environmental Studies** | Benny Joseph | Tata Mc Graw-Hill, 2nd Edition | 2012 |
| 3 | Environmental Studies – From Crisis to Cure R | Rajagopalan | Oxford Publisher | 2005 |
| | | | | |
| 1 | Principals of Environmental Science and Engineering | Raman Sivakumar | Cengage learning, Singapur | 2nd Edition, 2005 |
| 2 | Environmental Science - working with the Earth | G.Tyler Miller Jr. | Thomson Brooks /Cole | 11th Edition, 2006 |
| 3 | Text Book of Environmental and Ecology | Pratiba Sing, Anoop Singh & Piyush Malaviya | Acme Learning Pvt. Ltd. New Delhi. | 1st Edition |

## Semester: V
## Course Name: INTRODUCTION TO DATA STRUCTURES

| | | | |
|---|---|---|---|
| Course Code | **21CS551** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Should have a basic knowledge of C Programming.**

**Course objectives:**
1. Explain the fundamentals of data structures and their applications to solve real life problems.
2. Demonstrate the working of linear and nonlinear data structures.
3. Write solutions to problems using linear data structures and nonlinear data structures.
4. Apply different data structures to solve given problem.
5. Develop skills to apply appropriate data structures in problem solving.

**Module – 1** **08 Hours**

**Introduction:**
Introduction to Data Structures, Types of data structures, data structure operations.
Arrays: one-dimensional arrays, two dimensional arrays, initializing one dimensional and two dimensional arrays, operations on arrays.
**Structures and Unions:** Declaring structures, structure initialization, Introduction to unions
Functions: Built-in functions and user defined functions.

**Module – 2** **08 Hours**

**Linear Data Structures-Stacks and Queues:**
Introduction, Stack representation in Memory, Stack Operations, Stack Implementation, Applications of Stack, Recursion.
Introduction to Queues-Basic concept, Logical representation of Queues, Queue Operations and its types, Queue Implementation, Applications of Queue.

**Module – 3** **08 Hours**

**Linear Data Structures-Linked List:**
Introduction to Pointers: Pointer concepts, accessing variables through pointers, Dynamic memory allocation.
Introduction to Linked list, Logical representation of Linked list, Self-Referential structure, Singly-linked List Operations and its implementation, types of linked lists, introduction to circular linked list.

**Module – 4** **08 Hours**

**Non Linear Data Structures – Trees**
Terminologies, Binary Trees, Properties of Binary trees and representation, Binary Tree Traversal, Binary Search tree and its implementation.

**Module – 5** **08 Hours**

**Non Linear Data Structures –Graphs:** Introduction, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
**Hashing: I**ntroduction to hashing, Hashing Functions.

**Course Outcomes:**

The student will be able to

1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data structures using C | E Balaguruswamy | McGraw Hill | 2013 Edition |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | 2nd Edition,2014 |
| **Reference Books** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | 2nd Edition, 2014 |

## Semester: VI
## Course Name: INTRODUCTION DATABASE MANAGEMENT SYSTEMS

| | | | |
|---|---|---|---|
| Course Code | **21CS552** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

**Module - 2** **08 Hours**

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples
**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping

**Module – 3** **08 Hours**

**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Module – 4** **08 Hours**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

**Module – 5** **08 Hours**

**Normalization: Database Design Theory –** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.
**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

**Course Outcomes:**

1. Demonstrate the basic elements of a relational database management system.
2. Identify the data models for relevant problems.
3. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
4. Create, populate and manage relational databases in SQL.
5. Extend normalization for the development of application software

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata Mcgraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

## Semester: V
## Course Name: INTRODUCTION TO PYTHON PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | 21CS553 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Credits | 03 | Exam Hours | 03 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |

**Pre-Requisites:**
Basic Knowledge of Programming
Basic Knowledge of MS word, Excel and PDF

**Course objectives:**
1. Interpret the basic syntax and semantics of several expressions and functions.
2. Demonstrate the concepts of Iterations and files applied in real world scenario
3. Illustrate the python programs using Strings and Dictionaries.
4. Extend the importance of object oriented programming in python.
5. Implement inheritance concepts and File system to solve real world problems

**Module – 1** **03 Hours**

**Python Basics**, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Module - 2** **03 Hours**

**Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods

**Module – 3** **03 Hours**

**Reading and Writing Files,** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

**Module – 4** **03 Hours**

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Module – 5** **03 Hours**

**Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module

**Course Outcomes**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement python data structures to solve real world problems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist” | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| Reference Books | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press /Taylor & Francis | 1st Edition,2018 |

## Semester: V
## Course Name: INTRODUCTION TO OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **21CS554** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**The students should have the knowledge of:**
- Basics of computer system and its applications
- Basics of computer organization

**Course objectives:**
1. To introduce Operating System, OS responsibilities, and OS services.
2. To discuss process concept, process and scheduling techniques.
3. To demonstrate deadlock condition in the computer system.
4. To introduce memory management and virtual memory management concepts.
5. To explain file system.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.
**Operating System Services:** User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

**Module - 2** **08 Hours**

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication
**Process Scheduling**: Basic concepts; Scheduling Criteria; Scheduling Algorithms.

**Module – 3** **08 Hours**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Module – 4** **08 Hours**

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**Module – 5** **08 Hours**

**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Course Outcomes:**

1. Analyze the need of OS, responsibilities of OS, and OS services.
2. Compare different process scheduling techniques.
3. Examine deadlock situation, prevention, avoidance and recovery.
4. Implement virtual memory management concept and page replacement algorithms.
5. Discuss the file system.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed, , 2013. |

## Scheme of Teaching and Evaluation for

# B.E – VI Semester

# Computer Science & Engg.

## (2021 Scheme)

## Semester: VI
## Course Name: SOFTWARE PROJECT MANAGEMENT

| | | | |
|---|---|---|---|
| Course Code | **21CS61 / 21AI61** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**

**Course objectives:**
1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.

**Module – 1** **08 Hours**

**PROJECT EVALUATION AND PROJECT PLANNING**
Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**Module - 2** **08 Hours**

**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**
Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**Module – 3** **08 Hours**

**ACTIVITY PLANNING AND RISK MANAGEMENT**
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**Module – 4** **08 Hours**

**PROJECT MANAGEMENT AND CONTROL**
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**Module – 5** **08 Hours**

**STAFFING IN SOFTWARE PROJECTS**
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership

**Course Outcomes:**

1. Understand Project Management principles while developing software
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Software Project Management | Bob Hughes, Mike Cotterell and Rajib Mall | Tata McGraw Hill | Fifth and 2011 |
| 2 | Accounting for Management | Jawahar Lal | Wheeler Publications, Delhi | Fifth |
| **Reference Books** | | | | |
| 1 | Effective Software Project Management | Robert K. Wysocki | Wiley Publication | 2011 |
| 2 | Software Project Management | Walker Royce: | Addison-Wesley | 1998 |

## Semester: VI
## Course Name: COMPUTER NETWORKS

| | | | |
|---|---|---|---|
| Course Code | **21CS62** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**

**The students should have the knowledge of:**

- Basics of communication.
- Basics of computer networks

**Course objectives:**

1. Explain with the basics of data communication and various types of computer networks.
2. Comprehend the transmission techniques (DDC,ADC,DAC)
3. Discuss about router architecture, IP addressing, and routing algorithms in network layer.
4. Introduce the transport layer services and explain the working of UDP and TCP protocols.
5. Demonstrate the working, principles of application layer protocols, and various network security techniques.

**Module – 1** **08 Hours**

**Introduction:** Data Communications, Networks, Network Types, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer:** Data and Signals**,** Digital Signals, Transmission Impairment, Data Rate limits, Performance. **Digital Transmission**: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). Analog to digital conversion (only PCM), Transmission Modes, **Analog Transmission**: Digital to analog conversion.

**Module - 2** **08 Hours**

**Data link control**: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only). **Error Detection and Correction**: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction**. Media Access control**: Random Access, Controlled Access and Channelization

**Module – 3** **08 Hours**

**The Network layer:** Inside a Router, The internet protocol(IP), Datagram format, IPv4 Addressing, Internet Control Message Protocol(ICMP), IPv6, A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast.

**Module – 4** **08 Hours**

**Transport Layer :** Introduction and Transport-Layer Services: Overview of the Transport Layer in the Internet, Multiplexing and De-multiplexing: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.

**Module – 5** **08 Hours**

| |
|---|
| **Application Layer:** Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Application-Layer Protocols: The Web and HTTP: Overview of HTTP, HTTP Message Format, File Transfer: FTP Commands &Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet\'s Directory Service: Services Provided by DNS, Overview of How DNS Works, Peer-to-Peer Applications: P2P File Distribution<br>**Network Security:**<br>Overview of Network Security: Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures , Firewalls and Packet Filtering ,Packet Filtering , Proxy Server . |

**Course Outcomes:**

1. Analyze the types of networks.
2. Demonstrate and Compare the transmission techniques.
3. Analyze the router architecture, IP addressing, and routing algorithms in network layer.
4. Categorize the transport layer services and explain the working of UDP and TCP protocols.
5. Apply the working, principles of application layer protocols, and various network security techniques.

**Suggested Learning Resources:**

**Text Books:**

1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013.
2. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.
3. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

**Reference Books:**

1. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

## Semester: VI
## Course Name: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| | | | |
|---|---|---|---|
| Course Code | **21CS63** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Data Structures & Algorithms, Theory of probability and statistical analysis**

**Course objectives:**
1. Define machine learning and problems relevant to machine learning.
2. Interpret a wide variety of learning algorithms.
3. Develop an appreciation for what is involved in learning from data.
4. Differentiate supervised, unsupervised and reinforcement learning.
5. Apply performance evaluation parameters (statistical analysis) on learning algorithms, model selection for problems of machine learning.

**Module – 1: Introduction to AI** **08 Hours**

**AI and Agents:** Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments. The Structure of Agents.
**Search Algorithms:** Hill Climbing, Simulated Annealing, AND-OR Search, The A* approach, AO*, Constraint Satisfaction, Means Ends Analysis.

**Module – 2: Machine Learning & Concept Learning** **08 Hours**

**Machine Learning:** Well posed learning problems
**Concept Learning**: Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.

**Module – 3: Classification & Prediction** **08 Hours**

**Classification**: Decision Tree Learning - Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.
**Prediction**: Artificial Neural Network - Introduction, NN representation, Appropriate problems, Perceptron's, Back propagation algorithm.

**Module – 4: Bayesian Learning & Instance based learning** **08 Hours**

**Bayesian Learning**: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Naive Bayes classifier.
**Instance based learning:** k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function.

**Module – 5: Clustering** **08 Hours**

Clustering: Overview- Types of clustering, Types of clusters, K-Means, Agglomerative Hierarchical, Clustering, Density-Based Clustering, Graph-Based Clustering, Cluster evaluation.

**Course Outcomes:**

**Students will be able to**

1. Demonstrate the underlying principles of artificial intelligence.
2. Summarize the machine Learning algorithms and their limitations.
3. Applying common machine Learning algorithms in practice and implement on their own.
4. Apply supervised & un-supervised learning algorithms for problem solving.
5. Performing distributed computations using Bayesian learning.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence – A Modern Approach | Stuart Russell & Peter Norvig | Prentice Hall | 3rd Edition, |
| 2 | Machine Learning | Tom. M. Mitchell | McGraw-Hill Science | 1997. |
| 3 | Data Mining: Concepts & Techniques | Jiawei Han & Micheline Kamber, Jian Pei | The Morgan Kaufmann Series | 3rd Edition. |
| **Reference Books** | | | | |
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight and Shivashankar B Nair | McGraw-Hill Education | Third Edition, 2015. |

## Semester: VI
## Course Name: CLOUD COMPUTING

| | | | |
|---|---|---|---|
| Course Code | **21CS641 / 21AI641** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Basic Knowledge of Computer Networks
- Basic Knowledge of DBMS
- Python Programming Knowledge

**Course objectives:**
1. To learn various concepts and technologies of clouds.
2. To identify all the available cloud services
3. To understand the design approaches to cloud applications
4. To utilize Hadoop & MapReduce frameworks for developing cloud applications
5. To develop various cloud based applications using python

**Module – 1** **08 Hours**

**Introduction to Cloud Computing:** Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud-based Services & Applications.
**Cloud Concepts & Technologies:** Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring.

**Module - 2** **08 Hours**

**Cloud Concepts & Technologies:** Software Defined Networking, Network Function Virtualization, MapReduce, Identity and Access Management, Service Level Agreements, Billing.
**Cloud Services & Platforms:** Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment & Management Services, Identity & Access Management Services, Open Source Private Cloud Software.

**Module – 3** **08 Hours**

**Hadoop & MapReduce**: Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.
**Cloud Application Design:** Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

**Module – 4** **08 Hours**

**Python for Cloud:** Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure.

**Module – 5** **08 Hours**

**Python for Cloud:** Python for MapReduce, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.
**Cloud Application Development in Python:** Design Approaches, Document Storage App, MapReduce App.

**Course Outcomes:**

**At the end of the course the student will be able to:**

1. Outline the concepts and technologies of clouds.
2. Identify all the available cloud services
3. Analyze the design methodologies of cloud applications
4. Utilize suitable platforms for developing cloud applications
5. Develop cloud various applications using python

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Cloud Computing: A Hands on Approach | Arshdeep Bahga, Vijay Madisetti | ISBN/EAN13: 1494435144/9781494435141 | 2013 |
| **Reference Books** | | | | |
| 1 | Cloud Computing: A Practical Approach for Learning and Implementation | A. Srinivasan, J. Suresh | 1st Edition, Pearson Publications | 2014 |
| 2 | Explain the Cloud Like I'm 10 | Todd Hoff | | 2017 |

## Semester: VI
## Course Name: BLOCKCHAIN TECHNOLOGY

| | | | |
|---|---|---|---|
| Course Code | 21CS642 / 21AI642 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Credits | 03 | Exam Hours | 03 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |

**Pre-Requisites:**
- Basic idea of networks
- Basic idea of cloud computing

**Course objectives:**
1. To describe the fundamentals of distributed computing and evaluate the role it plays in blockchain technology.
2. To examine the fundamentals of cryptography and assess how they affect blockchain technology.
3. To assess the advantages, disadvantages, and various uses of blockchain technology.
4. To become familiar with the technology used in Bitcoin
5. To demonstrate proficiency in utilizing the Ethereum platform to develop blockchain applications.

**Module – 1** **08 Hours**

**Blockchain 101:** Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **Decentralization and Cryptography:** Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

**Module - 2** **08 Hours**

**Introduction to Cryptography & Cryptocurrencies:** Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency.
**How Bitcoin Achieves Decentralization:** Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together

**Module – 3** **08 Hours**

**Mechanics of Bitcoin:** Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.
**How to Store and Use Bitcoins:** Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

**Module – 4** **08 Hours**

**Bitcoin Mining:** The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.
**Bitcoin and Anonymity:** Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash

**Module – 5** **08 Hours**

**Smart Contracts and Ethereum 101:** Smart Contracts: Definition, Ricardian contracts. **Ethereum 101:** Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

**Course Outcomes:**

**The student should be able to**

1. Interpret the principles of Distributed computing and analyze its significance in Blockchain technology.
2. Analyze the principles of Cryptography and evaluate its impact on Blockchain technology.
3. Evaluate the benefits, drawbacks, and diverse applications of Blockchain technology
4. Impart the technologies involved in Bitcoin
5. Utilize the Ethereum platform to develop blockchain applications

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained | Imran Bashir | Packt Publishing Ltd, Second Edition | 2017 |
| 2 | Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction | Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark | Princeton University Press | 2016 |
| **Reference Books** | | | | |
| 1 | Mastering Bitcoins: Unlocking Digital Cryptocurrencies | Andreas Antonopoulos | O'Reilly Media, Inc | 2013 |

## Semester: VI
## Course Name: NATURAL LANGUAGE PROCESSING

| | | | |
|---|---|---|---|
| Course Code | **21CS643 / 21AI643** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Knowledge of Python, Data Structures & Algorithms**

**Course objectives:**
1. Introduce the fundamental techniques of natural language processing.
2. Analyze the natural language text.
3. Describe types of classifiers used for text classification.
4. Understand the concepts of Text mining.
5. Illustrate information retrieval techniques.

**Module – 1** **08 Hours**

**Introduction to NLP**
NLP in real world, NLP tasks, Language – Building Blocks of Language, NLP challenges, Machine Learning, Deep Learning and NLP overview, Approaches to NLP – Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP
**NLP Pipeline**
Generic NLP pipeline, Data Acquisition,

**Module - 2** **08 Hours**

**NLP Pipeline**
Text Extraction and Clean up – Normalization, Spelling Correction, System Specific Error Correction, Preprocessing – Word Tokenization, Stemming and Lemmatization
**Text Representation**
Vector Space Model, Bag of words, N – gram, TF – IDF, Word Embedding's – Continuous bag of words (CBOW), Skip Gram.

**Module – 3** **08 Hours**

**Text Classification**
Naïve Bayes classifier, Logistic Regression, Support Vector Machine, CNNs and LSTMs for Text Classification, Case study – Corporate Ticketing

**Module – 4** **08 Hours**

**Information Extraction (IE)**
IE Applications, IE Tasks, Pipeline for IE, Key phrase Extraction, Named Entity Recognition (NER) – Building and NER system, NLP using Active Learning, Dis-ambiguity and Linking Relationship Extraction - Approaches to RE

**Module – 5** **08 Hours**

**Chat bots**
A simple FAQ chat bots, Taxonomy of chat bots – Goal oriented Dialog, Chit chats, Pipeline for building dialog systems, Components of Dialog system – Dialog Act classification, identifying slots, Response Generation, End – to – End approach, Deep Reinforcement Learning for Dialog Generation, Human – in – the – Loop.

**Course Outcomes:**

The student will be able to-

1. Apply hidden Markov models, and word embeddings to implement autocorrect, auto complete and identify part-of-speech tags for words.
2. Apply logistic regression and naïve Bayes to implement NLP applications that perform sentiment analysis.
3. Illustrate word vectors to complete analogies and translate words.
4. Demonstrate the concepts of neural networks, LSTM, GRUs for sentiment analysis, text generation and named entity recognition.
5. Design NLP applications that perform question-answering and create tools to translate languages and even build chat bots.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems | Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana | OReilly | 1st Edition, 2020 |
| **Reference Books** | | | | |
| 1 | Natural Language Understanding | James Allen | Pearson Education | |
| 2 | Speech and Language Processing | Jurafsky Dan & Martin James H | Prentice Hall | 3rd Edition, 2023 |
| 3 | Natural Language Processing and Information Retrieval | Tanveer Siddiqui, U.S. Tiwary | Oxford University Press | 2008 |
| 4 | Natural Language Processing with Python | Steven Bird, Ewan Klein & Edward Loper | OReilly Media | 1st Edition, 2009 |
| 5 | Foundations of Statistical Natural Language Processing | Christopher D Manning & HinrichSchutze | MIT Press | 1999 |
| **Links** | | | | |
| 1 | https://nptel.ac.in/courses/106/105/106105158/ | | | |
| 2 | http://www.nptelvideos.in/2012/11/natural-language-processing.html | | | |

## Semester: VI
## Course Name: COMPUTER NETWORKS LAB

| | | | |
|---|---|---|---|
| Course Code | **21CSL66** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Demonstrate operation of network simulator (NS3) and its management commands
2. Simulate and demonstrate the performance of bus, star, and congestion window.
3. Implement the network and transport layer protocols.
4. Demonstrate the error detection techniques to detect the errors and cryptographic techniques for providing security.
5. Implement socket programming using TCP/UDP.

## List of Experiments:
## Part A

**Identify the requirements, then design and develop solutions in NS3:**
1. Installation of NS3 & configuration of NetAnim software.
2. Implement two nodes **point – to – point** network with duplex links between them. vary the data rate & delay to see the output on NetAnim
3. Implement Bus topology.
4. Implement Star topology.
5. Implement LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
6. Implement a hybrid topology by connecting multiple routers and nodes.

## Part B
### Implement the programs based on the following concepts (using Java/python)
7. Error detection mechanism.
8. Shortest path between the source and destination.
9. TCP/IP socket programming.
10. UDP socket programming.
11. Encryption and decryption of the data
12. Congestion control algorithm.

**Course Outcomes:**
1. Analyze the networking concepts in NS3 simulator
2. Apply star, bus, hybrid topologies' concepts to simulate a network using NS3 simulator.
3. Implement the network layer and transport layer algorithms like link state and leaky bucket algorithm.
4. Evaluate the error detection techniques to detect the errors and cryptographic techniques for providing security.
5. Design and develop an application for client/server architecture using TCP and UDP.

## Semester: VI
## Course Name: AI & ML Lab

| | | | |
|---|---|---|---|
| Course Code | **21CSL67** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Define machine learning and problems relevant to machine learning.
2. Interpret a wide variety of learning algorithms.
3. Develop an appreciation for what is involved in learning from data.
4. Differentiate supervised, unsupervised and reinforcement learning.
5. Apply performance evaluation parameters (statistical analysis) on learning algorithms, model selection for problems of machine learning.

## List of Experiments:
## Part A

**Identify the functional requirements, then Design Develop solutions to the problems related to:**
1. Implement **Find S algorithm**.
2. Implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the **decision tree based ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Implement the concept of Random Forest.
5. Build an Artificial Neural Network by implementing the **Back propagation algorithm** and test the same using appropriate data sets.
6. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.
7. Demonstrate the working of SVM Classifier
8. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
9. Apply **EM algorithm** to cluster a set of data. Use the same data set for clustering using **k-Means algorithm.** Compare the results of these two algorithms and comment on the quality of clustering.
10. Demonstrate the working of Density Based Clustering (DB Scan Algorithm)

**Course Outcomes:**
1. Identify and Apply Artificial Intelligence & machine learning concepts to solve real world problems of moderate complexity.
2. Apply the fundamentals of concept learning for various problems/applications.
3. Apply basic rules of Bayes theorem.
4. Solve problems using appropriate supervised, unsupervised algorithms.
5. Perform experiments in Machine Learning using real-world data.

## Semester: VI
## Course Name: MINI PROJECT

| | | | |
|---|---|---|---|
| Course Code | **21MN68** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:4** | SEE Marks | **50** |
| Credits | **2** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Mini-Project Work:**
Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

**CIE procedure for Mini-project:**

i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the **project report, project presentation skill, and question and answer session** in the ratio of **50:25:25**. The marks awarded for the project report shall be the same for all the batches mates.

ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the **project report, project presentation skill, and question and answer session** in the ratio **50:25:25**. The marks awarded for the project report shall be the same for all the batch mates.

## Semester: VI
## Course Name: COMPUTER GRAPHICS USING OPENGL

| | | | |
|---|---|---|---|
| Course Code | **21CS69A** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Pre-Requisites:**
1. Basic operations of vectors and matrices.
2. Basic concepts of 2-D computer graphics.
3. Good programming skills in C or C++

**Course objectives:**
1. Apply the mathematical concepts and fundamentals of computer graphics to visualize objects in the computer
2. Examine the coordinate systems of computer graphics
3. Evaluate 2D, 3D transformation of objects
4. Determine process of plotting objects using graphics library toolkit
5. Interpret and animated solution to solve real world problems

**Design, develop, and implement the following programs using OpenGL API**
1. Implement different Geometrical Primitives using various types of Symbolic Constants in OpenGL
2. Implement Brenham's line drawing algorithm for all types of slope.
   Refer: Text-1: Chapter 3.5
   Refer: Text-2: Chapter 8
3. Create and rotate a triangle about the origin and a fixed point.
   Refer: Text-1: Chapter 5-4.
4. 3. Draw a color cube and spin it using OpenGL transformation matrices.
   Refer: Text-2: Modelling a Colored Cube.
5. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing.
   Refer: Text-2: Topic: Positioning of Camera.
6. Clip a lines using Cohen-Sutherland algorithm
   Refer: Text-1: Chapter 6.7
   Refer: Text-2: Chapter 8
7. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
   Refer: Text-2: Topic: Lighting and Shading
8. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user.
   Refer: Text-2: Topic: sierpinski gasket.
9. Develop a menu driven program to animate a flag using Bezier Curve algorithm
   Refer: Text-1: Chapter 8-10
10. Develop a menu driven program to fill the polygon using scan line algorithm
    Refer: Text-1: Chapter 2

**Course Outcomes**
1. Apply the concepts of computer graphics
2. Implement computer graphics applications using OpenGL
3. Implement real world problems using OpenGL

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer Graphics-OpenGL | Donald Hearn & Pauline Baker | Pearson Education | 2011 |
| 2 | OpenGL Programming Guide | Dave Shriner | Pearson Education | 2010 |
| **Reference Books** | | | | |
| 1 | Interactive computer graphics- A Top Down approach with OpenGL | Edward Angel | Pearson Education | 2011 |
| 2 | Computer Graphics using OpenGL Fillip Learning | M MRaikar | Elsevier | 2013 |

## Semester: VI
## Course Name: MOBILE APPLICATION DEVELOPMENT

| | | | |
|---|---|---|---|
| Course Code | **21CS69B** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P:S) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**

- **Knowledge of JAVA programming**

**Course objectives:**

1. To understand the architecture and components of android application
2. To design interactive user interface
3. To design interface using Specialized Fragments
4. To work with SQLite database
5. To develop an Android Application to solve real world problems

**Module – 1** **03 Hours**

**Getting Started with Android Programming:** Android, Features of Android, Android Architecture, obtaining the required tools, launching your first android application.

**Module - 2** **03 Hours**

**Activities, Fragments and Intents:** Understanding activities, linking activities using intents, fragments

**Module – 3** **03 Hours**

**Getting to know the Android User Interface:** Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView

**Module – 4** **03 Hours**

**Designing User Interface with Views:** TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews, ProgressBar View, AutoCompleteTextView View, TimePicker View, DatePickerView, ListView View, SpinnerView

**Module – 5** **03 Hours**

**Understanding Specialized Fragments:** List Fragment, DialogFragment, PreferenceFragment
**Creating and using Databases:** Creating the DBAdapter Helper class, using the database programmatically

**Course Outcomes:**

1. Understand various application components in android.
2. Design efficient user interface using different layouts.
3. Develop application using Specialized Fragments
4. Develop application with persistent data storage using SQLite
5. Develop an interactive applications using android studio

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Beginning Android Programming with Android Studio | J. F. DiMarzio | 4thEdition | 2017 |
| **Reference Books** | | | | |
| 1 | Android Programming for Beginners | John Horton | 1stEdition | 2015 |
| 2 | Head First Android Development | Dawn Griffiths & David Griffiths | O'Reilly, 1stEdition | 2015 |

## Semester: VI
## Course Name: ROBOTIC PROCESS AUTOMATION

| | | | |
|---|---|---|---|
| Course Code | **21CS69C** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites: Basic Programming Concepts**

**Course objectives:**
At the end of the course, the student will be able to
1. Outline the basic concepts of RPA.
2. Understand the various components of RPA, where it can be applied and how it implemented
3. Describe the different types of variables, Control Flow and data manipulation techniques
4. Model the workflow of various control techniques and OCR in RPA
5. Interpret use of exception handling techniques to handle the log errors.

**Module – 1** **03 Hours**

**RPA Foundations**:
What is RPA – Flavors of RPA- **History of RPA-** The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall DevOps- Flowcharts.

**Module - 2** **03 Hours**

**RPA Platforms**:
Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio - Task recorder - Step-by- step examples using the recorder.

**Module – 3** **03 Hours**

**Sequence, Flowchart, and Control Flow**:
Sequencing the workflow- Activities - Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope- Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).

**Module – 4** **03 Hours**

**Taking Control of the Controls**:
Finding and attaching windows- Finding the 08 control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.

**Module – 5** **03 Hours**

**Exception Handling:**
Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting.

**Course Outcomes:**

**The student should be able to:**

1. Discuss the fundamental & basic principles of Robotic Process Automation, Applications in various industries.
2. Summarize the various components & Platforms of RPA.
3. Analyze the different types of variables, control flow and data manipulation techniques.
4. Apply various control techniques and OCR in RPA
5. Design and develop a bot to capture runtime exception & handling of such type of exceptions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems | Tom Taulli | A press | 2020, ISBN-13 (electronic): 978-1-4842-5729-6 |
| 2 | Learning Robotic Process Automation | Alok Mani Tripathi | Packt Publishing | March 2018 ISBN: (electronic): 9781788470940 |
| **Reference Books** | | | | |
| 1 | Introduction to Robotic Process Automation: a Primer | Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston | Institute of Robotic Process Automation | |
| 2 | Richard Murdoch | Robotic Process Automation: Guide To Building Software Robots | Automate Repetitive Tasks & Become An RPA Consultant | |

## Semester: VI
## Course Name: PROGRAMMING IN JAVA

| | | | |
|---|---|---|---|
| Course Code | **21CS651** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Students should know the basic knowledge on:**
- C Programming
- C++

**Course objectives:**
1. Learn fundamental features of object oriented language and JAVA.
2. To create, debug and run simple Java programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object Oriented concepts.

**Module – 1** **08 Hours**

**Introduction to Java**: Java's magic: The Bytecode, The Java Buzzwords.
**An Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Lexical Issues.
**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.

**Module - 2** **08 Hours**

**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.
**Control Statements:** Java's Selection Statements, Iteration Statements, Jump Statements.

**Module – 3** **08 Hours**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class.
**A Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

**Module – 4** **08 Hours**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces.
**Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

**Module – 5** **08 Hours**

**Enumerations:** Enumerations.
**I/O**: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files, Automatically Closing a File.
**String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.

**Course Outcomes:**
1. Identify classes, objects, members of a class and relationship among them needed for a specific problem.
2. Develop JAVA application programs using control statements.
3. Implement reusability Programs in JAVA using inheritance.
4. Develop JAVA Programs of error handling techniques using exception handling.
5. Demonstrate string handling concepts using JAVA.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8th Edition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balagurusamy | Tata McGraw Hill | |

## Semester: VI
## Course Name: INTRODUCTION TO DATA ANALYTICS

| | | | |
|---|---|---|---|
| Course Code | **21CS652** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module - 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
**Advanced data visualization**- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

## Semester: VI
## Course Name: Introduction to Artificial Intelligence & Machine Learning

| | | | |
|---|---|---|---|
| Course Code | **21CS653** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Knowledge of Mathematics & Data Structures and Algorithms**

**Course objectives:**
1. Understands the basics of AI, history of AI and its foundations, basic principles of AI for problem solving.
2. Compare and contrast different AI techniques available.
3. Define and explain learning algorithms
4. Explore the basics of Machine Learning & Machine Learning process, understanding data
5. Understand the Working of Artificial Neural Networks.

**Module – 1** **08 Hours**

**Introduction:** What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents.

**Module - 2** **08 Hours**

**Problem solving by searching:** Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions

**Module – 3** **08 Hours**

**Introduction to machine learning:** Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.
**Understanding Data:** What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization.

**Module – 4** **08 Hours**

**Understanding Data:** Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,
**Basics of Learning Theory:** Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.
**Similarity-based learning:** Introduction to Similarity or instance based learning, Nearest-neighbour learning, weighted k- Nearest - Neighbour algorithm.

**Module – 5** **08 Hours**

**Artificial Neural Network:** Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Design intelligent agents for solving simple gaming problems.
2. Apply techniques to solve the AI problems
3. Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning
4. Understand data and applying machine learning algorithms to predict the outputs.
5. Model the neuron and Neural Network, and to analyze ANN learning and its applications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence A Modern Approach | Stuart Russel, Peter Norvig | Pearson Education | 3rd Edition, 2015 |
| 2 | Machine Learning | S. Sridhar, M Vijayalakshmi | Oxford | 2021 |
| **Reference Books** | | | | |
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3rd Edition, 2009 |
| 2 | Principles of Artificial Intelligence | Nils J. Nilsson | Elsevier | 1980 |

## Semester: VI
## Course Name: INTRODUCTION TO CYBER SECURITY

| | | | |
|---|---|---|---|
| Course Code | **21CS654** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**The students should have the knowledge of:**
- Awareness about the loopholes/drawbacks of the advanced technologies on which the society is dependent.
- Awareness about the crimes being done through technology.

**Course objectives:**
1. To familiarize the cybercrime terminologies and perspectives.
2. To illustrate the phases of cybercrime plan and different types of cybercrimes.
3. To gain the knowledge about the tools and methods used by the criminals.
4. To reveal the techniques used in phishing and identity theft.
5. To emphasize the necessary of computer and cyber forensics.

**Module – 1** **08 Hours**

**Introduction to Cybercrime:**
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**Module - 2** **08 Hours**

**Cyber Offenses:**
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

**Module – 3** **08 Hours**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

**Module – 4** **08 Hours**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

**Module – 5** **08 Hours**

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**Course Outcomes:**

1. Identify the various terminologies being used in cybercrime.
2. Categorize the types of cybercrimes.
3. Illustrate the tools and methods used by criminals for cybercrime.
4. Compare the various techniques used in phishing and identity theft.
5. Utilize various cyber security techniques including cyber forensics.

**Suggested Learning Resources:**

**Text Books:**

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

**Reference Books:**

2. Neil Daswani, Moudy Elbayadi Big Breaches: "Cyber-security Lessons for Everyone", Feb 2021

*** *** ***

<table>
<tr><td colspan="4">ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS71</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>4:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –4</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS71) will enable students to:</td></tr>
<tr><td colspan="4">• Explain Artificial Intelligence and Machine Learning<br>• Illustrate AI and ML algorithm and their use in appropriate applications</td></tr>
</table>

| **Module 1** | **Contact Hours** |
|---|---|
| What is artificial intelligence?, Problems, problem spaces and search, Heuristic search techniques<br>**Texbook 1: Chapter 1, 2 and 3**<br>**RBT: L1, L2** | 10 |
| **Module 2** | |
| Knowledge representation issues, Predicate logic, Representaiton knowledge using rules.<br>Concpet Learning: Concept learning task, Concpet learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.<br>**Texbook 1: Chapter 4, 5 and 6**<br>**Texbook2: Chapter 2 (2.1-2.5, 2.7)**<br>**RBT: L1, L2, L3** | 10 |
| **Module 3** | |
| Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorith.<br>Aritificil Nueral Network: Introduction, NN representation, Appropriate problems, Perceptrons, Backpropagation algorithm.<br>**Texbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5)**<br>**RBT: L1, L2, L3** | 10 |
| **Module 4** | |
| Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Navie Bayes classifier, BBN, EM Algorithm<br>**Texbook2: Chapter 6**<br>**RBT: L1, L2, L3** | 10 |
| **Module 5** | |
| Instance-Base Learning: Introduction, k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function, Case-Based reasoning.<br>Reinforcement Learning: Introduction, The learning task, Q-Learning.<br>**Texbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)**<br>**RBT: L1, L2, L3** | 10 |

**Course Outcomes:** The student will be able to :

- Appaise the theory of Artificial intelligence and Machine Learning.
- Illustrate the working of AI and ML Algorithms.
- Demonstrate the applications of AI and ML.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Tom M Mitchell,**"Machine Lerning",**1st Edition, McGraw Hill Education, 2017.
2. Elaine Rich, Kevin K and S B Nair, **"Artificial Inteligence",** 3rd Edition, McGraw Hill Education, 2017.

**Reference Books:**

1. Saroj Kaushik, Artificial Intelligence, Cengage learning
2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition
3. AurÈlienGÈron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
5. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press
6. Srinvivasa K G and Shreedhar, " Artificial Intelligence and Machine Learning", Cengage

| **BIG DATA AND ANALYTICS**<br>**(Effective from the academic year 2018 -2019)**<br>**SEMESTER – VII** | | | |
|---|---|---|---|
| **Course Code** | **18CS72** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 4:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 50 | **Exam Hours** | 03 |
| **CREDITS –4** | | | |

**Course Learning Objectives:** This course (18CS72) will enable students to:

- Understand fundamentals of Big Data analytics
- Explore the Hadoop framework and Hadoop Distributed File system
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
- Employ MapReduce programming model to process the big data
- Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

| **Module 1** | **Contact Hours** |
|---|---|
| **Introduction to Big Data Analytics:** Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.<br>**Text book 1: Chapter 1: 1.2 -1.7**<br>**RBT: L1, L2, L3** | 10 |
| **Module 2** | |
| **Introduction to Hadoop (T1):** Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.<br>**Hadoop Distributed File System Basics (T2):** HDFS Design Features, Components, HDFS User Commands.<br>**Essential Hadoop Tools (T2):** Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.<br>**Text book 1: Chapter 2 :2.1-2.6**<br>**Text Book 2: Chapter 3**<br>**Text Book 2: Chapter 7 (except walk throughs)**<br>**RBT: L1, L2, L3** | 10 |
| **Module 3** | |
| **NoSQL Big Data Management, MongoDB and Cassandra:** Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.<br>**Text book 1: Chapter 3: 3.1-3.7**<br>**RBT: L1, L2, L3** | 10 |
| **Module 4** | |
| **MapReduce, Hive and Pig:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.<br>**Text book 1: Chapter 4: 4.1-4.6**<br>**RBT: L1, L2, L3** | 10 |

| Module 5 | |
|---|---|
| **Machine Learning Algorithms for Big Data Analytics:** Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining.<br>**Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics:<br>**Text book 1: Chapter 6: 6.1 to 6.5**<br>**Text book 1: Chapter 9: 9.1 to 9.5** | 10 |

**Course Outcomes:** The student will be able to:

- Understand fundamentals of Big Data analytics.
- Investigate Hadoop framework and Hadoop Distributed File system.
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
- Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
- Use Machine Learning algorithms for real world big data.
- Analyze web contents and Social Networks to provide analytics with relevant visualization tools.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**


1. Raj Kamal and Preeti Saxena, "**Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning",** McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, **"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem",** 1st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351


**Reference Books:**


1. Tom White, **"Hadoop: The Definitive Guide",** 4th Edition, O'Reilly Media, 2015.ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, **"Professional Hadoop Solutions",** 1st Edition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, **"Hadoop Operations: A Guide for Developers and Administrators",**1st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madisetti, **"Big Data Analytics: A Hands-On Approach",** 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

**SOFTWARE ARCHITECTURE AND DESIGN PATTERNS**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS731** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS731) will enable students to:

- Learn How to add functionality to designs while minimizing complexity.
- What code qualities are required to maintain to keep code flexible?
- To Understand the common design patterns.
- To explore the appropriate patterns for design problems

| **Module 1** | **Contact Hours** |
|---|---|
| **Introduction**: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. A Notation for Describing Object-Oriented Systems<br>**Textbook 1: Chapter 1 and 2.7**<br>**Analysis a System**: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.<br>**Textbook 1: Chapter 6**<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| **Design Pattern Catalog**: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.<br>**Textbook 2: chapter 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| **BehavioralPatterns:** Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method<br>**Textbook 2: chapter 5**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| **Interactive systems and the MVC architecture**: Introduction, The MVC architectural pattern, analyzing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incompleteitems, adding a new feature, pattern-based solutions.<br>**Textbook 1: Chapter 11**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| **Designing with Distributed Objects:** Client server system, java remote method invocation, implementing an object-oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.<br>**Textbook 1: Chapter 12**<br>**RBT: L1, L2, L3** | 08 |

**Course Outcomes:** The student will be able to :

- Design and implement codes with higher performance and lower complexity
- Be aware of code qualities needed to keep code flexible

- Experience core design principles and be able to assess the quality of a design with respect to these principles.
- Capable of applying these principles in the design of object oriented systems.
- Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary.
- Be able to select and apply suitable patterns in specific contexts

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**


1. Brahma Dathan, Sarnath Rammath, Object-oriented analysis, design and implementation, Universities Press,2013
2. Erich Gamma, Richard Helan, Ralph Johman, John Vlissides , Design Patterns, Pearson Publication,2013.


**Reference Books:**


1. Frank Bachmann, RegineMeunier, Hans Rohnert “Pattern Oriented Software Architecture” –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

<table>
<tr><td colspan="4">HIGH PERFORMANCE COMPUTING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS732</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS732) will enable students to:</td></tr>
<tr><td colspan="4">• Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications.<br>• Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.</td></tr>
<tr><td colspan="3">Module – 1</td><td>Contact Hours</td></tr>
<tr><td colspan="3">Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.<br>T1: Ch: 1.1, 1.2, 2.1 – 2.7<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 2</td></tr>
<tr><td colspan="3">Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models<br>Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations<br>T1: Ch 3, 4<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Module – 3</td></tr>
<tr><td colspan="3">Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs<br>Section 5.7. Other Scalability Metrics,<br>Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators<br>T1: Ch 5, 6<br>RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="4">Module – 4</td></tr>
<tr><td colspan="3">Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation,</td><td>08</td></tr>
</table>

| | |
|---|---|
| Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming<br>Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations<br>Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort.<br>**T1: Ch 7, 8 9**<br>**RBT: L1, L2** | |
| **Module – 5** | |
| Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs,<br>Search Algorithms for Discrete Optimization Problems: Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup, Anomalies in Parallel Search Algorithms<br>**T1: Ch10, 11**<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Illustrate the key factors affecting performance of CSE applications
- Illusrate mapping of applications to high-performance computing systems
- Apply hardware/software co-design for achieving performance on real-world applications

**Question paper pattern:**

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.

**Reference Books:**

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

| ADVANCED COMPUTER ARCHITECTURES<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Course Code** | **18CS733** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS733) will enable students to:

- Describe computer architecture.
- Measure the performance of architectures in terms of right parameters.
- Summarize parallel architecture and the software used for them

| **Module 1** | **Contact Hours** |
|---|---|
| Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws. For all Algorithm or mechanism any one example is sufficient.<br>**Chapter 1 (1.1to 1.4), Chapter 2( 2.1 to 2.4) Chapter 3 (3.1 to 3.3)**<br>**RBT: L1, L2** | 08 |
| **Module 2** | |
| Hardware Technologies 1: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology. For all Algorithms or mechanisms any one example is sufficient.<br>**Chapter 4 ( 4.1 to 4.4)**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| Hardware Technologies 2: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models, Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors. For all Algorithms or mechanisms any one example is sufficient.<br>**Chapter 5 (5.1 to 5.4) Chapter 6 (6.1 to 6.2)**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| Parallel and Scalable Architectures: Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Message-Passing Mechanisms, Multivector and SIMD Computers, Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers. For all Algorithms or mechanisms any one example is sufficient.<br>**Chapter 7 (7.1,7.2 and 7.4) Chapter 8( 8.1 to 8.3) Chapter 9(9.1 to 9.3)**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays. Instruction and System Level Parallelism, Instruction Level Parallelism, Computer Architecture, Contents, Basic Design Issues, Problem Definition, Model of a Typical | 08 |

| | |
|---|---|
| Processor, Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo's Algorithm. For all Algorithms or mechanisms any one example is sufficient.<br>**Chapter 10(10.1 to 10.3) Chapter 12( 12.1 to 12.9)**<br>**RBT: L1, L2, L3** | |

**Course Outcomes:** The student will be able to :

- Explain the concepts of parallel computing and hardware technologies
- Compare and contrast the parallel architectures
- Illustrate parallel programming concepts

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

**Reference Books:**

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013

<table>
<tr><td colspan="4">USER INTERFACE DESIGN<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS734</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS –3</td></tr>
<tr><td colspan="4">Course Learning Objectives: This course (18CS734) will enable students to:</td></tr>
<tr><td colspan="4">• To study the concept of menus, windows, interfaces<br>• To study about business functions<br>• To study the characteristics and components of windows andthe various controls for the windows.<br>• To study about various problems in windows design with color, text, graphics a<br>• nd To study the testing methods</td></tr>
<tr><td colspan="3">Module 1</td><td>Contact Hours</td></tr>
<tr><td colspan="3">The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design<br>Textbook 1: Ch. 1,2<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="3">Module 2</td><td></td></tr>
<tr><td colspan="3">The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.<br>Textbook 1: Part-2<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="3">Module 3</td><td></td></tr>
<tr><td colspan="3">System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.<br>Textbook 1: Part-2<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="3">Module 4</td><td></td></tr>
<tr><td colspan="3">Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.<br>Textbook 1: Part-2<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="3">Module 5</td><td></td></tr>
<tr><td colspan="3">Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.<br>Textbook 1: Part-2<br>RBT: L1, L2</td><td>08</td></tr>
<tr><td colspan="4">Course Outcomes: The student will be able to :</td></tr>
<tr><td colspan="4">• Design the User Interface, design, menu creation, windows creation and connection between menus and windows</td></tr>
<tr><td colspan="4">Question Paper Pattern:</td></tr>
<tr><td colspan="4">• The question paper will have ten questions.<br>• Each full Question consisting of 20 marks</td></tr>
</table>

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**


1. Wilbert O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition 2002.


**Reference Books:**


1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
2. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

| DIGITAL IMAGE PROCESSING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Course Code** | **18CS741** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS741) will enable students to:

- Define the fundamental concepts in image processing
- Evaluate techniques followed in image enhancements
- Illustrate image segmentation and compression algorithms

| **Module 1** | **Contact Hours** |
|---|---|
| **Introduction** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Examples of fields that uses digital mage processing<br>**Textbook 1: Ch.1.3 to 1.5, Ch. 2.4,2.5**<br>**RBT: L1, L2** | 08 |
| **Module 2** | |
| **Image Enhancement In The Spatial Domain:** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.<br>**Textbook 1: Ch.3**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| **Image Enhancement In Frequency Domain:** Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.<br>**Textbook 1: Ch.4.1,4.2**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| **Image Segmentation**: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.<br>**Textbook 1: Ch.10.1 to 10.3**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| **Image Compression**: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.<br>**Textbook 1: Ch. 8.1 to 8.5**<br>**RBT: L1, L2, L3** | 08 |

**Course Outcomes:** The student will be able to :

- Explain fundamentals of image processing
- Compare transformation algorithms

| |
|---|
| • Contrast enhancement, segmentation and compression techniques |
| **Question Paper Pattern:** |
| • The question paper will have ten questions.<br>• Each full Question consisting of 20 marks<br>• There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module. |
| **Textbooks:** |
| 1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 2nd edition, 2008. |
| **Reference Books:** |
| 1. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.<br>2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.<br>3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.<br>4. Digital Image Processing (with Matlab and Labview), Vipul singh, elsiver.Filip learning |

| NETWORK MANAGEMENT<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Course Code** | **18CS742** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS742) will enable students to:

- Illustrate the need for interoperable network management.
- Explain the concepts and architecture behind standards based network management.
- Differentiate the concepts and terminology associated with SNMP and TMN
- Describe network management as a typical distributed application

| **Module 1** | **Contact Hours** |
|---|---|
| **Introduction:** Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.<br>**Textbook 1: Ch.1**<br>**RBT: L1, L2** | 08 |
| **Module 2** | |
| Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.<br>**Textbook 1: Ch.3**<br>**RBT: L1, L2** | 08 |
| **Module 3** | |
| SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.<br>**Textbook 1: Ch. 4,5, Ch.8**<br>**RBT: L1, L2** | 08 |
| **Module 4** | |

| | |
|---|---|
| Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles<br>**Textbook 1: Ch. 13**<br>**RBT: L1, L2** | 08 |
| **Module 5** | |
| Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.<br>**Textbook 1: Ch.11**<br>**RBT: L1, L2** | 08 |

**Course Outcomes:** The student will be able to :

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Identify the various components of network and formulate the scheme for the managing them

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

**Reference Books:**

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

**NATURAL LANGUAGE PROCESSING**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS743** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS743) will enable students to:

| **Module – 1** | **Contact Hours** |
|---|---|
| **Overview and language modeling:** Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.<br>**Textbook 1: Ch. 1,2**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 2** | |
| **Word level and syntactic analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.<br>**Textbook 1: Ch. 3,4**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 3** | |
| **Extracting Relations from Text: From Word Sequences to Dependency Paths:** Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.<br>**Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles:** Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.<br>**A Case Study in Natural Language Based Web Search:** InFact System Overview, The GlobalSecurity.org Experience.<br>**Textbook 2: Ch. 3,4,5**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 4** | |
| **Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models:** Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems,<br>**Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures:** Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.<br>**Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling:** Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.<br>**Evolving Explanatory Novel Patterns for Semantically-Based Text Mining:** Related Work, A Semantically Guided Model for Effective Text Mining.<br>**Textbook 2: Ch. 6,7,8,9**<br>**RBT: L1, L2, L3** | 08 |

| Module – 5 | |
|---|---|
| **INFORMATION RETRIEVAL AND LEXICAL RESOURCES:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora.<br>**Textbook 1: Ch. 9,12**<br>**RBT: L1, L2, L3** | 08 |

**Course outcomes:** The students should be able to:

- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

**Question paper pattern:**

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**


1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.


**Reference Books:**


1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

| CRYPTOGRAPHY<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Course Code** | **18CS744** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS744) will enable students to:

- Define cryptography and its principles
- Explain Cryptography algorithms
- Illustrate Public and Private key cryptography
- Explain Key management, distribution and ceritification
- Explain authentication protocols
- Tell about IPSec

| Module – 1 | Contact Hours |
|---|---|
| **Classical Encryption Techniques** Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm<br>**Textbook 1: Ch. 2.1,2.2, Ch. 3**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| **Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, desription of the algorithm, computational aspects, the security of RSA.<br><br>**Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack,Elgamal Cryptographic systems<br>**Textbook 1: Ch. 9, Ch. 10.1,10.2**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.<br><br>**Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory,public key | 08 |

| | |
|---|---|
| authority, public keys certificates.<br>**Textbook 1: Ch. 10.3-10.5, Ch.14.1 to 14.3**<br>**RBT: L1, L2** | |
| **Module – 4** | |
| X-509 certificates. Certificates, X-509 version 3, public key infrastructure .**User Authentication:** Remote user Authentication principles, Mutual Authentication, one wayAuthentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication. **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.<br>**Textbook 1: Ch. 14.4, Ch. 15.1 to 15.4, Ch.19**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service<br><br>**Transport and tunnel modes**, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.<br>**Textbook 1: Ch. 20.1 to 20.3**<br>**RBT: L1, L2** | 08 |
| **Course outcomes:** The students should be able to: | |
| • Define cryptography and its principles<br>• Explain Cryptography algorithms<br>• Illustrate Public and Private key cryptography<br>• Explain Key management, distribution and ceritification<br>• Explain authentication protocols<br>• Tell about IPSec | |
| **Question paper pattern:**<br>• The question paper will have ten questions.<br>• There will be 2 questions from each module.<br>• Each question will have questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module. | |
| **Text Books:** | |
| 1. William Stallings: Cryptography and Network Security, Pearson 6th edition. | |
| **Reference Books:** | |
| 1. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition. | |

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ

"ವಿಟಿಯು ಅಧಿನಿಯಮ ೧೯೯೪ರ ಅಡಿಯಲ್ಲಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ ಸ್ಥಾಪಿತವಾದ ರಾಜ್ಯ ವಿಶ್ವವಿದ್ಯಾಲಯ

"ಜ್ಞಾನ ಸಂಗಮ", ಬೆಳಗಾವಿ-೫೯೦೦೧೮, ಕರ್ನಾಟಕ, ಭಾರತ

**Visvesvaraya Technological University**

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Ref: VTU/BGM/BOS/A9/2020-21 / 2719

Date: 23 SEP 2021

## CIRCULAR

**Subject**: Updated syllabus of 18CS745 regarding...

**Reference**:

1. Approval of Chairperson BoS in CSE dated 08.09.2021
2. Approval of Hon'ble Vice-Chancellor, dated: 13.09.2021

This is to inform all concerned that the Professional Elective Course "**Robotic Process Automation Design & Development (18CS745)** in Computer Science and Engineering program has been modified to map with chapter contents of the prescribed textbook. The updated syllabus copy has been enclosed with the circular for kind reference to the stakeholders.

The principals of all the Engineering Colleges coming under the ambit of the University are hereby informed to bring the updated syllabus of 18CS745 to the notice of the faculty and students of the CSE / department of your college.

21.9.2021

**REGISTRAR**

Encl: As mentioned above.

To,

The Principals of all affiliated/ constituent /Autonomous Engineering Colleges, under the ambit of VTU Belagavi.

Copy to.

1. To the Hon'ble Vice-Chancellor through the secretary to VC, VTU Belagavi for information
2. The Registrar (Evaluation), VTU Belagavi for information.
3. The Regional Directors (I/c) of all the regional offices of VTU for circulation.
4. The Director ITI SMU CNC Belagavi for uploading on VTU website
5. PS to Registrar VTU Belagavi
6. All the concerned Special Officer/s and Caseworker/s of the academic section, VTU, Belagavi

## ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT

(Effective from the academic year 2018-2019)

**SEMESTER–VII**

| | | | |
|---|---|---|---|
| CourseCode | **18CS745** | CIEMarks | 40 |
| NumberofContactHours/Week | 3:0:0 | SEEMarks | 60 |
| TotalNumberofContactHours | 40 | ExamHours | 3Hrs |
| | | **CREDITS** | 03 |

**Course Learning Objectives:** This course(18CS745) will enable students to:

1. To understand basic concepts of RPA
2. To Describe RPA, where it can be applied and how it implemented
3. To Describe the different types of variables, Control Flow and data manipulation techniques
4. To Understand Image,Text and Data Tables Automation
5. To Describe various types of Exceptions and strategies to handle

| Module–1 | Contact Hours |
|---|---|
| **RPA Foundations**- What is RPA – Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 DevOps- Flowcharts.<br>**Textbook 1: Ch 1, Ch 2, RBT:L1,L2** | 08 |
| **Module–2** | |
| **RPA Platforms**- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder.<br>**Textbook 2: Ch 1, Ch 2, RBT: L1, L2** | 08 |
| **Module–3** | |
| **Sequence, Flowchart, and Control Flow**-Sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope-Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-stepexample).<br>**Textbook 2: Ch 3, Ch 4, RBT:L1,L2** | 08 |
| **Module–4** | |
| **Taking Control of the Controls**- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.<br>**Text book 2: Ch 5 RBT:L1,L2** | 08 |

**Module–5**

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA 08

**Text book 2: Ch 8 Text book 1: Ch 13 RBT:L1,L2**

**Courseoutcomes:**Thestudentsshouldbeableto:

- To Understand the basic concepts of RPA
- To Describevarious components and platforms of RPA
- To Describe the different types of variables, control flow and data manipulation techniques
- To Understand various control techniques and OCR in RPA
- ToDescribevarioustypes andstrategies tohandle exceptions

**Questionpaperpattern:**

- The question paper will have tenquestions.
- There will be 2questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Tom Taulli, The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : A press
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

**Reference Books:**

1. Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston,"Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4. https://www.uipath.com/rpa/robotic-process-automation

<table>
<tr><td colspan="5">INTRODUCTION TO BIG DATA ANALYTICS<br>(OPEN ELECTIVE)<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS751</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5">CREDITS –3</td></tr>
<tr><td colspan="5">Course Learning Objectives: This course (18CS751) will enable students to:</td></tr>
<tr><td colspan="5">• Interpret the data in the context of the business.<br>• Identify an appropriate method to analyze the data<br>• Show analytical model of a system</td></tr>
<tr><td colspan="4">Module – 1</td><td>Teaching Hours</td></tr>
<tr><td colspan="4">Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step Modeling Process.Describing the Distribution of a Single Variable:Introduction,Basic Concepts, Populations and Samples, Data Sets,Variables,and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools,Charts for Numerical Variables, Time Series Data, Outliers and Missing Values,Outliers,Missing Values, Excel Tables for Filtering,Sorting,and Summarizing.<br>Finding Relationships among Variables: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables.<br>Textbook 1: Ch. 1,2,3<br>RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="5">Module – 2</td></tr>
<tr><td colspan="4">Probability and Probability Distributions:Introduction,Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Courseive Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation.<br>Normal,Binormal,Poisson,and Exponential Distributions:Introduction,The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density,Standardizing:Z-Values,Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution.<br>Textbook 1: Ch. 4,5<br>RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="5">Module – 3</td></tr>
<tr><td colspan="4">Decision Making under Uncertainty:Introduction,Elements of Decision Analysis, Payoff</td><td>08</td></tr>
</table>

| | |
|---|---|
| Tables, Possible Decision Criteria, Expected Monetary Value(EMY),Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In,Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility Maximization Used?<br>**Sampling and Sampling Distributions**: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling.<br>**Textbook 1: Ch. 6,7**<br>**RBT: L1, L2, L3** | |
| **Module – 4** | |
| **Confidence Interval Estimation**: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters.<br>**Hypothesis Testing**:Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence.<br>**Textbook 1: Ch. 8,9**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 5** | |
| **Regression Analysis**: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit.<br>**Regression Analysis**: Statistical Inference:Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction.<br>**Textbook 1: Ch. 10,11**<br>**RBT: L1, L2, L3** | 08 |
| **Course outcomes:** The students should be able to: | |
| • Explain the importance of data and data analysis<br>• Interpret the probabilistic models for data | |

- Define hypothesis, uncertainty principle
- Evaluate regression analysis

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**


1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cenage Learning


**Reference Books:**


1. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577
2. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966

**PYTHON APPLICATION PROGRAMMING**
**(OPEN ELECTIVE)**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VI**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS752** | **IA Marks** | 40 |
| **Number of Lecture Hours/Week** | 3:0:0 | **Exam Marks** | 60 |
| **Total Number of Lecture Hours** | 40 | **Exam Hours** | 03 |

**CREDITS – 03**

**Course Learning Objectives:**This course (18CS752) will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

| **Module – 1** | **Teaching Hours** |
|---|---|
| Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions<br>**Textbook 1: Chapters 1 – 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 2** | |
| Iteration, Strings, Files<br>**Textbook 1: Chapters 5– 7**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 3** | |
| Lists, Dictionaries, Tuples, Regular Expressions<br>**Textbook 1: Chapters 8 - 11**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 4** | |
| Classes and objects, Classes and functions, Classes and methods<br>**Textbook 2: Chapters 15 – 17**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 5** | |
| Networked programs, Using Web Services, Using databases and SQL<br>**Textbook 1: Chapters 12– 13, 15**<br>**RBT: L1, L2, L3** | 08 |

**Course Outcomes:**After studying this course, students will be able to

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**


1. Charles R. Severance, **“Python for Everybody: Exploring Data Using Python 3”,** 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf )
2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist”,** 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)


**Reference Books:**


1. Charles Dierbach, **"Introduction to Computer Science Using Python",**1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
2. Gowrishankar S, Veena A, **“Introduction to Python Programming”,** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372
3. Mark Lutz, **“Programming Python”,**4th Edition, O’Reilly Media, 2011.ISBN-13: 978-9350232873
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, **“Data Structures and Algorithms in Python”,**1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. Reema Thareja, **“Python Programming Using Problem Solving Approach”,** Oxford university press, 2017. ISBN-13: 978-0199480173

| INTRODUCTION TO ARTIFICIAL INTELLIGENCE<br>(OPEN ELECTIVE)<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Course Code** | **18CS753** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS753) will enable students to:

- Identify the problems where AI is required and the different methods available
- Compare and contrast different AI techniques available.
- Define and explain learning algorithms

| Module – 1 | Teaching Hours |
|---|---|
| What is artificial intelligence?, Problems, Problem Spaces and search<br>**TextBook1: Ch 1, 2**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules,<br>**TextBoook1: Ch 4, 5 and 6.**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Symbolic Reasoning under Uncertainty, Statistical reasoning<br>**TextBoook1: Ch 7, 8**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| Game Playing, Natural Language Processing<br>**TextBoook1: Ch 12 and 15**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Learning, Expert Systems.<br>**TextBook1: Ch 17 and 20**<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Identify the AI based problems
- Apply techniques to solve the AI problems
- Define learning and explain various learning techniques
- Discuss on expert systems

**Question paper pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

| |
|---|
| 1. E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill. |
| **Reference Books:** |
| 1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.<br>2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.<br>3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem Solving”, Fourth Edition, Pearson Education, 2002.<br>4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.<br>5. N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford University Press-2015 |

<table>
<tr><td colspan="4" align="center">INTRODUCTION TO DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT<br>(OPEN ELECTIVE)<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII</td></tr>
<tr><td>Course Code</td><td>18CS754</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Contact Hours/Week</td><td>3:0:0</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Contact Hours</td><td>40</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS –3</td></tr>
</table>

**Course Learning Objectives:** This course (18CS754) will enable students to:

- Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
- Understand Object Oriented Programming concepts in C# programming language.
- Interpret Interfaces and define custom interfaces for application.
- Build custom collections and generics in C#
- Construct events and query data using query expressions

| Module – 1 | Teaching Hours |
|---|---|
| **Introducing Microsoft Visual C# and Microsoft Visual Studio 2015:** Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions<br>**T1: Chapter 1 – Chapter 6**<br>**RBT: L1, L2** | 08 |
| **Module – 2** | |
| **Understanding the C# object model:** Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays<br>**Textbook 1: Ch 7 to 10**<br>**RBT: L1, L2** | 08 |
| **Module – 3** | |
| Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management<br>**Textbook 1: Ch 11 to 14**<br>**RBT: L1, L2** | 08 |
| **Module – 4** | |
| **Defining Extensible Types with C#:** Implementing properties to access fields, Using indexers, Introducing generics, Using collections<br>**Textbook 1: Ch 15 to 18**<br>**RBT: L1, L2** | 08 |
| **Module – 5** | |
| Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading<br>**Textbook 1: Ch 19 to 22**<br>**RBT: L1, L2** | 08 |

**Course outcomes:** The students should be able to:

- Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
- Demonstrate Object Oriented Programming concepts in C# programming language

- Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
- Illustrate the use of generics and collections in C#
- Compose queries to query in-memory data and define own operator behaviour

**Question paper pattern:**

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

**Text Books:**

1. John Sharp, Microsoft Visual C# Step by Step, $8^{th}$ Edition, PHI Learning Pvt. Ltd. 2016

**Reference Books:**


1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

| ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY (Effective from the academic year 2018 -2019) SEMESTER – VII | | | |
|---|---|---|---|
| **Course Code** | **18CSL76** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 0:0:2 | **SEE Marks** | 60 |
| **Total Number of Lab Contact Hours** | 36 | **Exam Hours** | 03 |
| **Credits – 2** | | | |

**Course Learning Objectives:** This course (18CSL76) will enable students to:

- Implement and evaluate AI and ML algorithms in and Python programming language.

**Descriptions (if any):**

**Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.**

**Programs List:**

| | |
|---|---|
| 1. | Implement A* Search algorithm. |
| 2. | Implement AO* Search algorithm. |
| 3. | For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithmto output a description of the set of all hypotheses consistent with the training examples. |
| 4. | Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample. |
| 5. | Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. |
| 6. | Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. |
| 7. | Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. |
| 8. | Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. |
| 9. | Implement the non-parametric Locally Weighted Regressionalgorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs |

**Laboratory Outcomes**: The student should be able to:

- Implement and demonstrate AI and ML algorithms.
- Evaluate different algorithms.

**Conduct of Practical Examination:**

- Experiment distribution
  - o For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
  - o For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution *(Courseed to change in accoradance with university regulations)*
  - q) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
  - r) For laboratories having PART A and PART B
    - i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
    - ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

| INTERNET OF THINGS<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Course Code** | **18CS81** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS81) will enable students to:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identifysensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

| **Module 1** | **Contact Hours** |
|---|---|
| What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.<br>**Textbook 1: Ch.1, 2**<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.<br>**Textbook 1: Ch.3, 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.<br>**Textbook 1: Ch.5, 6**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment<br>**Textbook 1: Ch.7, 8**<br>**RBT: L1, L2, L3** | 08 |
| **Module 5** | |
| IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT | 08 |

| | |
|---|---|
| Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.<br>**Textbook 1: Ch.12**<br>**Textbook 2: Ch.7.1 to 7.4, Ch.8.1 to 8.4, 8.6**<br>**RBT: L1, L2, L3** | |

**Course Outcomes:** The student will be able to :

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1stEdition, Pearson Education (Cisco Press Indian Reprint). (**ISBN:** 978-9386873743)
2. Srinivasa K G, **"Internet of Things",**CENGAGE Leaning India, 2017

**Reference Books:**

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1stEdition, VPT, 2014. (**ISBN:** 978-8173719547)
2. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224)

**Mandatory Note:**
Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessment

**Maintain a copy of the report for verification during LIC visit.**

**Posssible list of practicals:**

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

| MOBILE COMPUTING<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Course Code** | **18CS821** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |

**Course Learning Objectives:** This course (18CS821) will enable students to:

- Define concepts of wireless communication.
- Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- Explain CDMA, GSM. Mobile IP, WImax and Different Mobile OS
- Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

| **Module 1** | **Contact Hours** |
|---|---|
| Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks : Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications<br>**Textbook1: 2.4 - 2.6, 4.4 - 4.6, 5, 6.**<br>**RBT: L1, L2** | 08 |
| **Module 2** | |
| GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices.<br>**Textbook 1: 7,9.2 - 9.7, 12.2 - 12.6**<br>**RBT: L1, L2** | 08 |
| **Module 3** | |
| Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators<br>**Textbook 2: 7, 8.**<br>**RBT: L1, L2** | 08 |
| **Module 4** | |
| Building Wireless Internet Applications: Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications | 08 |

| | |
|---|---|
| Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, 10 Hours HTML, cHTML, XHTML, VoiceXML.<br>**Textbook 2: 11, 12, 13**<br>**RBT: L1, L2** | |
| **Module 5** | |
| J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.<br>**Textbook 1: 15.1 - 15.10**<br>**RBT: L1, L2** | 08 |
| **Course Outcomes:** The student will be able to : | |
| The students shall able to:<br>• Explain state of art techniques in wireless communication.<br>• Discover CDMA, GSM. Mobile IP, WImax<br>• Demonstrate program for CLDC, MIDP let model and security concerns | |
| **Question paper pattern:**<br>The question paper will have ten questions.<br>There will be 2 questions from each module.<br>Each question will have questions covering all the topics under a module.<br>The students will have to answer 5 full questions, selecting one full question from each module. | |
| **Text Books:**<br>1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.<br>2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003 | |
| **Reference Books:**<br>1. Raj kamal: Mobile Computing, Oxford University Press, 2007.<br>2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009. | |

| STORAGE AREA NETWORKS<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **Course Code** | **18CS822** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS822) will enable students to:

- Evaluate storage architectures,
- Define backup, recovery, disaster recovery, business continuity, and replication
- Examine emerging technologies including IP-SAN
- Understand logical and physical components of a storage infrastructure
- Identify components of managing and monitoring the data center
- Define information security and identify different storage virtualization technologies

| **Module 1** | **Contact Hours** |
|---|---|
| **Storage System: Introduction to Information Storage**: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. **Data Center Environment:** Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components,Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application<br>**Textbook1 : Ch.1.1 to 1.4, Ch.2.1 to 2.10**<br>**RBT: L1, L2** | 08 |
| **Module 2** | |
| **Data Protection - RAID :** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. **Intelligent Storage Systems :** Components of an Intelligent Storage System, Types of Intelligent Storage Systems. **Fibre Channel Storage Area Networks - Fibre Channel:** Overview, The SAN and Its Evolution, Components of FC SAN.<br>**Textbook1 : Ch.3.1 to 3.6, Ch. 4.1, 4.3, Ch. 5.1 to 5.3**<br>**RBT: L1, L2** | 08 |
| **Module 3** | |
| **IP SAN and FCoE:** iSCSI, FCIP, **Network-Attached Storage:** General-Purpose Servers versus NAS Devices,Benefi ts of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance<br>**Textbook1 : Ch.6.1, 6.2, Ch. 7.1 to 7.8**<br>**RBT: L1, L2** | 08 |
| **Module 4** | |
| **Introduction to Business Continuity:** Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions, **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments<br>**Textbook1 : Ch.9.1 to 9.6, Ch. 10.1 to 10.9**<br>**RBT: L1, L2** | 08 |
| **Module 5** | |
| **Local Replication:** Replication Terminology, Uses of Local Replicas, Replica Consistency , Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. **Remote Replication:** Modes of Remote | 08 |

| | |
|---|---|
| Replication, Remote Replication Technologies. **Securing the Storage Infrastructure:** Information Security Framework, Risk Triad, Storage Security Domains. Security Implementations in Storage Networking<br>**Textbook1 : Ch.11.1 to 11.7, Ch. 12.1, 12.2, Ch. 14.1 to 14.4**<br>**RBT: L1, L2** | |

**Course Outcomes:** The student will be able to :

- Identify key challenges in managing information and analyze different storage networking technologies and virtualization
- Explain components and the implementation of NAS
- Describe CAS architecture and types of archives and forms of virtualization
- Illustrate the storage infrastructure and management activities

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**

1. EMC Education Services, **"Information Storage and Management"**, Wiley India Publications, 2009. ISBN: 9781118094839

**Reference Books:**

1. Paul Massiglia, Richard Barker, **"Storage Area Network Essentials: A Complete Guide to Understanding and Implementating SANs Paperback",** 1st Edition, Wiley India Publications, 2008

| NOSQL DATABASE<br>(Effective from the academic year 2018 -2019)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **Course Code** | **18CS823** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |
| **CREDITS –3** | | | |
| **Course Learning Objectives:** This course (18CS823) will enable students to: | | | |
| • Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).<br>• Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.<br>• Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases. | | | |

| **Module 1** | **Contact Hours** |
|---|---|
| Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL,<br>Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.<br>More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access,<br>**Textbook1: Chapter 1,2,3**<br>**RBT: L1, L2, L3** | 08 |
| **Module 2** | |
| Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.<br>Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums.<br>Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes<br>**Textbook1: Chapter 4,5,6**<br>**RBT: L1, L2, L3** | 08 |
| **Module 3** | |
| Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce<br>Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets<br>**Textbook1: Chapter 7,8**<br>**RBT: L1, L2, L3** | 08 |
| **Module 4** | |
| Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Dif erent Operations, Queries against Varying Aggregate Structure<br>**Textbook1: Chapter 9** | 08 |

| | |
|---|---|
| **RBT: L1, L2, L3** | |
| **Module 5** | |
| Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.<br>**Textbook1: Chapter 11**<br>**RBT: L1, L2, L3** | 08 |

**Course Outcomes:** The student will be able to :

- Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Textbooks:**


1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012


**Reference Books:**


1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN-13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

**MULTICORE ARCHITECTURE AND PROGRAMMING**
**(Effective from the academic year 2018 -2019)**
**SEMESTER – VII**

| | | | |
|---|---|---|---|
| **Course Code** | **18CS824** | **CIE Marks** | 40 |
| **Number of Contact Hours/Week** | 3:0:0 | **SEE Marks** | 60 |
| **Total Number of Contact Hours** | 40 | **Exam Hours** | 03 |

**CREDITS –3**

**Course Learning Objectives:** This course (18CS824) will enable students to:

- Define technologies of multicore architecture and performance measures
- Demonstrate problems related to multiprocessing
- Illustrate windows threading, posix threads, openmp programming
- Analyze the common problems in parallel programming

| **Module -1** | **Contact Hours** |
|---|---|
| Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.<br>**Textbook 1: Ch.1, 2**<br>**RBT: L1, L2, L3** | 08 |
| **Module -2** | |
| Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features<br>**Textbook 1: Ch.3, 4**<br>**RBT: L1, L2, L3** | 08 |
| **Module – 3** | |
| Threading APIs :ThreadingAPls for Microsoft Windows, Win32/MFC Thread APls, Threading APls for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.<br>**Textbook 1: Ch.5**<br>**RBT: L1, L2, L3** | 08 |
| **Module-4** | |
| OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, | 08 |

<table>
<tr><td>OpenMP Environment Variables, Compilation, Debugging, performance<br>Textbook 1: Ch.6<br>RBT: L1, L2, L3</td><td></td></tr>
<tr><td>Module-5</td><td></td></tr>
<tr><td>Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,Data Organization for High Performance.<br>Textbook 1: Ch.7<br>RBT: L1, L2, L3</td><td>08</td></tr>
<tr><td colspan="2">Course Outcomes: The student will be able to :</td></tr>
<tr><td colspan="2">• Identify the limitations of ILP and the need for multicore architectures<br>• Define fundamental concepts of parallel programming and its design issues<br>• Solve the issues related to multiprocessing and suggest solutions<br>• Make out the salient features of different multicore architectures and how they exploit parallelism<br>• Demonstrate the role of OpenMP and programming concept</td></tr>
<tr><td colspan="2">Question Paper Pattern:</td></tr>
<tr><td colspan="2">• The question paper will have ten questions.<br>• Each full Question consisting of 20 marks<br>• There will be 2 full questions (with a maximum of four sub questions) from each module.<br>• Each full question will have sub questions covering all the topics under a module.<br>• The students will have to answer 5 full questions, selecting one full question from each module.</td></tr>
<tr><td colspan="2">Textbooks:</td></tr>
<tr><td colspan="2">1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006</td></tr>
<tr><td colspan="2">Reference Books:</td></tr>
<tr><td colspan="2">1. Yan Solihin, "Fundamentals of Parallel Multicore Architecture", 1st Edition, CRC Press/Taylor and Francis, 2015.<br>2. GerassimosBarlas, "Multicore and GPU Programming: An Integrated Approach Paperback", 1st Edition, Morgan Kaufmann, 2014.<br>3. Lyla B Das, "The x86 Microprocessors: 8086 to Pentium, Multicores, Atom and the 8051 Microcontroller: Architecture, Programming and Interfacing", 2nd Edition, Pearson Education India, 2014</td></tr>
</table>

# Scheme of Teaching and Evaluation for

# B.E – V & VI Semester

# Computer Science & Engg.

## (2021 Scheme)

**Scheme of Teaching and Evaluation for B.E Program**

# Computer Science & Engineering

**With effect from the Academic Year 2021-22**
**Total Credits for B.E.: 160**
**Credits Distribution as per NEP 2020**

| SEM | HS | BS | ES | PC | PE | AEC | OE | PW | INT | SE | UHV | TOTA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | **20** |
| **2** | 2 | 7 | 10 | - | - | 1 | - | - | - | - | - | **20** |
| **3** | 1 | 3 | - | 12 | - | 2 | - | - | - | - | - | **18** |
| **4** | 1 | 3 | - | 12 | - | 3 | - | - | 2 | - | 1 | **22** |
| **5** | 1 | - | - | 11 | 3 | 2 | 3 | - | - | - | - | **20** |
| **6** | 3 | - | - | 8 | 3 | 1 | 3 | 2 | 2 | - | - | **22** |
| **7** | - | - | - | 7 | 3 | - | 3 | 8 | - | - | - | **21** |
| **8** | - | - | - | 3 | - | - | - | - | 13 | 1 | - | **17** |
| **TOTAL** | **10** | **20** | **20** | **53** | **9** | **10** | **9** | **10** | **17** | **1** | **1** | **160** |

| SN | Course Area | Credit Distribution |
|---|---|---|
| **1.** | Humanities Social Sciences including Management (HS) | 10 |
| **2.** | Basic Sciences (BS) | 20 |
| **3.** | Engineering Sciences (ES) | 20 |
| **4.** | Professional Core (PC) | 53 |
| **5.** | Professional Electives (PE) | 09 |
| **6.** | Ability Enhancement Course(AEC) | 10 |
| **7.** | Open Electives | 09 |
| **8.** | Project Work(Mini/Major) | 10 |
| **9.** | Internship(INT) | 17 |
| **10.** | Seminar (SE) | 01 |
| **11.** | Universal Human Values(UHV) | 01 |
| **12.** | Mandatory Non-Credit Course (MNC) | - |
| | **Total** | **160** |
| **The above is based on the VTU guidelines and the AICTE Model Curriculum** | | |

# Semester: V

| SN | Course | Course Code | Course Title | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours /Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | PCC | 21CS51 | Automata Theory & Compiler Design | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21CS52 | System Software and Operating System | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CS53 / 21AI53 | Database Management System | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CS54X / 21AI54X | Professional Elective – 1 | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CS55X /21AI55X | Open Elective - 1 | Other departments offering the course | Other departments offering the course | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CSL56 / 21AIL56 | DBMS Lab with Mini Project | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21CSL57 | System Software & Operating System Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | AEC | 21ADA580 | Advanced Aptitude | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 09 | AEC | 21CS58X / 21AI58X | AEC | Concerned Department | CSE | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 10 | HS | 21ENV59 | Environmental Studies | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| **Total** | | | | | | | | | **20** | | **500** | **500** | 1000 |

| | | |
|---|---|---|
| **Ability Enhancement Course** | | |
| 01 | 21CS581/ 21AI581 | C# and .Net Framework |
| 02 | 21CS582 / 21AI582 | PYTHON Programming |
| | | |
| **Professional Elective – 1** | | |
| 01 | 21CS541 / 21AI541 | Agile Technology |
| 02 | 21CS542 / 21AI542 | Introduction to Data Analytics |
| 03 | 21CS543 / 21AI543 | Cyber Security |
| | | |
| **Open Elective -1** | | |
| 01 | 21CS551 | Introduction to Data Structures |
| 02 | 21CS552 | Introduction to Database Management Systems |
| 03 | 21CS553 | Introduction to PYTHON Programming |
| 04 | 21CS554 | Introduction to Operating System |

# Semester: VI

| SN | Course | Course Code | Course Title | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours /Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | HS | 21CS61 / 21AI61 | Software Project Management | Humanities / Concerned Department | Humanities / CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21CS62 | Computer Networks | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21CS63 | Artificial Intelligence & Machine Learning | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21CS64X/ 21AI64X | Professional Elective – 2 | Concerned Department | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21CS65X /21AI65X | Open Elective - 2 | Other departments offering the course | CSE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21CSL66 | Computer Networks Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21CSL67 | AI&ML Lab | Concerned Department | CSE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | PW | 21MN68 | Mini Project | Concerned Department | CSE | Two contact hours /week for interaction between the faculty and students | | | 2 | 3 | 50 | 50 | 100 |
| 09 | AEC | 21CS69X /21AI69X | | Concerned Department | CSE | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| 10 | INT | 21INT691 | Summer Internship-II | Completed during the intervening period of IV and V semesters. | | | | | 2 | --- | 100 | - | 100 |
| **Total** | | | | | | | | | **22** | | **550** | **450** | **1000** |

| **Ability Enhancement Course** | | |
|---|---|---|
| 01 | 21CS69A | Computer Graphics using Open GL |
| 02 | 21CS69B | Mobile Application Development |
| 03 | 21CS69C | Robotic Process Automation |
| **Professional Elective – 2** | | |
| 01 | 21CS641 / 21AI641 | Cloud Computing |
| 02 | 21CS642 / 21AI642 | Block Chain Technology |
| 03 | 21CS643 / 21AI643 | Natural Language Processing |
| | | |
| 01 | 21CS651 | Programming in JAVA |
| 02 | 21CS652 | Introduction to Data Analytics |
| 03 | 21CS653 | Introduction to Artificial Intelligence & Machine Learning |
| 04 | 21CS654 | Introduction to Cyber Security |

## Internship – II (21INT691):

All the students admitted to engineering programmes shall have to undergo a mandatory internship-II of 04 weeks during the intervening vacation of IV and V semesters.

All the students **TAKING FAST TRACK /SUPPLEMENTARY SEMESTER** shall have to undergo a mandatory internship-II of 04 weeks during the intervening period of V and VI semesters. Internship-II shall include Innovation/ Entrepreneurship / Societal based Internship. A Viva-voce examination (Presentation followed by question-answer session) shall be conducted during VI semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examinations after satisfying the internship requirements The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.

# Scheme of Teaching and Evaluation for

# B.E – V Semester

# Computer Science & Engg.

# (2021 Scheme)

## Semester: V

## Course Name: AUTOMATA THEORY AND COMPILER DESIGN

| | | | |
|---|---|---|---|
| Course Code | **21CS51** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
Students must have a knowledge of basic concepts of set theory and any one of a programming Language

**Course objectives:**
1. Explain the basic concepts of Automata Theory and Compiler Design and design Finite Automata for given Regular Languages
2. Illustrate the concept of Regular expressions and explain the entire process of identifying lexemes and generating tokens from a given Source program
3. Demonstrate the concept of Context Free Grammars and Parse the given input string using Top-down Parser
4. Describe the working of PDA and to illustrate the process of Parsing of the given input string using Bottom-up Parser
5. Explain the process design of Turing Machine and Demonstrate the Concepts of Syntax Directed Translation, Intermediate Code Generation, Code Generation

**Module – 1** **08 Hours**

**Introduction to Automata Theory:** Central Concepts of Automata theory, Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA) ,Epsilon- NFA, NFA to DFA Conversion, Minimization of DFA
**Introduction to Compiler Design**: Language Processors, Phases of Compiler

**Module - 2** **08 Hours**

Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Proving Languages Not to Be Regular
Lexical Analysis Phase of compiler Design: Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens.

**Module – 3** **08 Hours**

**Context Free Grammars:** Definition and designing CFGs, Derivations Using a Grammar, Parse Trees, Ambiguity and Elimination of Ambiguity, Elimination of Left Recursion, Left Factoring.
Syntax Analysis: part-1: Role of Parser , Top-Down Parsing-Recursive Descent Parsing, FIRST and FOLLOW, Predictive LL(1) Parsing,

**Module – 4** **08 Hours**

Push Down Automata: Introduction, Formal Definition, Graphical notation and Instantaneous Descriptions of PDA, The Languages of a PDA-acceptance by Final state and empty stack.

Syntax Analysis Phase of Compilers: Part-2: Bottom-up Parsing, Introduction to LR Parsing: SLR Parsing-Items and the LR(0) Automaton , Constructing SLR Parsing Tables, SLR Parsing Algorithm

**Module – 5** **08 Hours**

| |
|---|
| **Introduction to Turing Machine:** Problems that Computers Cannot Solve, The Turing machine, problems, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine<br>**Other Phases of Compilers:** Syntax Directed Translation- Syntax-Directed Definitions, Annotated Parse tree, Evaluation Orders for SDD's. Intermediate-Code Generation- Variants of Syntax Trees, Three-Address Code. Code Generation- Issues in the Design of a Code Generator |

**Course Outcomes:**

**At the end of the course the student will be able to:**

1. Design Finite Automata for given Regular Languages
2. Demonstrate the process of generating stream of tokens from a given source program
3. Design Context Free Grammars, Predictive Parsing table and Parse the given input string using Predictive LL(1) Parser
4. Construct Push Down Automata, SLR Parsing table, Parse the given input string using SLR Parser
5. Design Turing Machine and explain Un-decidability, Syntax Directed translation, Intermediate code Generation and code Generation

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Automata Theory, Languages and Computation | John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman | Pearson | Third Edition |
| 2 | Compilers- Principles, Techniques and Tools | Alfred V.Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman | Pearson | Second Edition |
| **Reference Books** | | | | |
| 1 | Automata, Computability and Complexity | Elain Rich | Pearson Education | First Edition |
| 2 | Compiler Design | K Muneeswaran | Oxford University Press | First edition |

**Semester: V**

## Course Name: SYSTEM SOFTWARE AND OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **21CS52** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:** The students should have the knowledge of:
1. Basics of computer system and its applications
2. Basics of computer organization

**Course objectives:**
1. To introduce Operating System, OS responsibilities, and OS services.
2. To demonstrate process concept, scheduling techniques, and deadlock condition.
3. To discuss memory management and virtual memory management concepts.
4. To explain about system software, application software and classify the instruction formats, addressing modes of SIC and SIC/XE machine.
5. To illustrate the object code for SIC and SIC/XE machine programs.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer system organization; Computer system architecture; Operating system structure; Operating system operations; Process management; Memory management; Storage management.
**Operating System Services:** User-Operating system interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating system structure; Virtual machines.

**Module - 2** **08 Hours**

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication
**Process Scheduling**: Basic concepts; Scheduling criteria; Scheduling algorithms.
**Deadlocks:** Introduction to Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Module – 3** **08 Hours**

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**Module – 4** **08 Hours**

**Introduction to System Software**: Machine architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options.

**Module – 5** **08 Hours**

**Loaders and Linkers:** Basic loader functions, Machine dependent loader features, Machine independent loader features, Loader design options.

**Course Outcomes:**

At the end of the course the students will be able to:

1. Analyze the working of operating system, its responsibilities and services.
2. Illustrate the scheduling techniques and deadlock conditions of multiple processes.
3. Differentiate between memory and virtual memory with the help of various strategies like swapping, segmentation, and paging.
4. Distinguish between system software and application software.
5. Classify the different instruction formats and addressing modes of SIC and SIC/XE machine.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | System Software: An Introduction To Systems Programming | Leland L Beck & D Manjula | Pearson Education | Third 2012 |
| 2 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D. M. Dhamdhere | McGraw- Hill | 3rd Ed, 2013. |

## Semester: V
## Course Name: DATABASE MANAGEMENT SYSTEMS

| | | | |
|---|---|---|---|
| Course Code | **21CS53** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.
**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

**Module - 2** **08 Hours**

**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping
**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Module – 3** **08 Hours**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.
**Advanced Aggregation Features:** Ranking – dense rank, partition by
**Application Development:** Accessing SQL From a Programming Language, An introduction to JDBC, ODBC, Embedded SQL, SQLJ, Stored procedures

**Module – 4** **08 Hours**

**Normalization: Database Design Theory –** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.
**Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

**Module – 5** **08 Hours**

| |
|---|
| **Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.<br>**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. |

**Course Outcomes:**
1. Demonstrate the basic elements of a relational database management system.
2. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
3. Create, populate and manage relational databases in SQL.
4. Extend normalization for the development of application software.
5. Analyze and implement transaction processing, concurrency control, and database recovery protocols in database.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata Mcgraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

## Semester: V
## Course Name: AGILE TECHNOLOGY

| | | | |
|---|---|---|---|
| Course Code | **21CS541 / 21AI541** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Knowledge of Software Engineering and Programming Language**

**Course objectives:**
1. Explain the fundamental concepts of agile software engineering
2. Demonstrate the need to apply the principles of XP life cycle.
3. Evaluate various functionalities of XP programming.
4. Demonstrate concepts to Eliminate Waste

**Module – 1** **08 Hours**

**Agile:** Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **Agile Methods**, Don't Make Your Own Method, The Road to Mastery, Find a Mentor

**Module - 2** **08 Hours**

**Understanding XP:** The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us, Go!, Assess Your Agility

**Module – 3** **08 Hours**

**Practicing XP: Thinking:** Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives,
**Collaborating:** Trust, Sit Together, Real Customer, Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting,
**Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.
**Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

**Module – 4** **08 Hours**

**Mastering Agility: Values and Principles:** Commonalities, About Values, Principles, and Practices, Further Reading,
**Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules,
**Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People,
**Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

**Module – 5** **08 Hours**

**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence :**Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

**Course Outcomes:**

1. Interpret the concept of agile software engineering and its advantages in software development
2. Outline XP Lifecycle, XP Concepts, Adopting XP
3. Apply the principles of XP for real time examples.
4. Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
5. Demonstrate concepts to Eliminate Waste

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The Art of Agile Development | James shore, Chromatic, | O'Reilly | 2007 |
| **Reference Books** | | | | |
| 1 | Agile Software Development, Principles, Patterns, and Practices | Robert C. Martin | Prentice Hall | 1st edition, 2002 |
| 2 | Agile and Iterative Development A Manger's Guide | Craig Larman | Pearson Education | First Edition, India, 2004 |

## Semester: V
## Course Name: INTRODUCTION TO DATA ANALYTICS

| | | | |
|---|---|---|---|
| Course Code | **21CS542 / 21AI542** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module - 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
**Advanced data visualization-** structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

**At the end of the course the student will be able to:**

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools,and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

## Semester: V
## Course Name: CYBER SECURITY

| | | | |
|---|---|---|---|
| Course Code | **21CS543 / 21AI543** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**

**The students should have the knowledge of:**

- Awareness about the loopholes/drawbacks of the advanced technologies on which the society is dependent.
- Awareness about the crimes being done through technology.

**Course objectives:**

1. To familiarize the cybercrime terminologies and perspectives.
2. To illustrate the phases of cybercrime plan and different types of cybercrimes.
3. To gain the knowledge about the tools and methods used by the criminals.
4. To reveal the techniques used in phishing and identity theft.
5. To emphasize the necessary of computer and cyber forensics.

**Module – 1** **08 Hours**

**Introduction to Cybercrime:**
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**Module - 2** **08 Hours**

**Cyber Offenses:**
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

**Module – 3** **08 Hours**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

**Module – 4** **08 Hours**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

**Module – 5** **08 Hours**

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**Course Outcomes:**
1. Identify the various terminologies being used in cybercrime.
2. Categorize the types of cybercrimes.
3. Illustrate the tools and methods used by criminals for cybercrime.
4. Compare the various techniques used in phishing and identity theft.
5. Utilize various cyber security techniques including cyber forensics.

**Suggested Learning Resources:**

**Text Books:**
Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

**Reference Books:**
Neil Daswani, Moudy Elbayadi Big Breaches: "Cyber-security Lessons for Everyone", Feb 2021

**Semester: V**

**Course Name: DATABASE MANAGEMENT SYSTEM LAB WITH MINI PROJECT**

| | | | |
|---|---|---|---|
| Course Code | **21CSL56 / 21AIL56** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Create a database using fundamental SQL commands.
2. Analyze the database concepts to design a schema diagram.
3. Retrieving the data from the database.
4. Performing database operations in a procedural manner using SQL.
5. Design and develop applications like Employee, Movie management systems etc.

## List of Experiments:
## Part A

**Identify the functional requirements, then Design Develop solutions to the problems related to:**

1. **Aim: Discuss the various concepts on constraints and update operations.**
   Program: Consider the following schema for Order Database:
   SALESMAN(Salesman_id, Name, City, Commission)
   CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
   ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

   Write SQL queries to
   1. Count the customers with grades above Bangalore's average.
   2. Find the name and numbers of all salesman who had more than one customer.
   3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
   4. Create a view that finds the salesman who has the customer with the highest order of a day.
   5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

   **Reference:**
   https://www.youtube.com/watch?v=AA-KL1jbMeY
   https://www.youtube.com/watch?v=7S_tz1z_5bA

2. **Aim: Demonstrating creation of tables, applying the nested query concepts.**
   Program Consider the following schema for a Cricket Database:
   TEAM( tid, tname, coach, captain_pid , city)
   PLAYER( pid, pname, age, tid)
   STADIUM(sid, sname, pincode, city)
   MATCH(mid, mdate, time, sid, team1_id, team2_id, winning_team_id, man_of_match, pid)

   Write SQL queries to
   1. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
   2. List the details of the stadium where the maximum number of matches were played.
   3. List the details of the player who is not a captain but got the man_of _match award at least in two matches.
   4. Display the Team details who won the maximum matches.
   5. Display the team name where all its won matches played in the same stadium.

**Reference:**
https://www.youtube.com/watch?v=lBpSMeQjNqQ
https://www.youtube.com/watch?v=_yog7h4BokQ

3. **Aim: Demonstrate the concepts of JOIN operations.**
Program: Consider the schema for Movie Database:
ACTOR(Act_id, Act_Name, Act_Gender)
DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)

Write SQL queries to
1. List the titles of all movies directed by 'Hitchcock'.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'Steven Spielberg' to 5.

**Reference:**
https://www.youtube.com/watch?v=hSiCUNVKJAo
https://www.youtube.com/watch?v=IqQhPlJP64k

4. **Aim: Introduce concepts of PLSQL and usage on the table.**
Program: Consider the schema for College Database:
STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID)
COURSE(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to
1. List all the student details studying in fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
   If FinalIA = 17 to 20 then CAT = 'Outstanding'
   If FinalIA = 12 to 16 then CAT = 'Average'
   If FinalIA< 12 then CAT = 'Weak'

Give these details only for 8th semester A, B, and C section students.

**Reference:**
https://www.youtube.com/watch?v=horURQewW9c
https://www.youtube.com/watch?v=P7-wKbKrAhk

5. **Aim: Demonstrate the core concepts on table like procedure and trigger queries and also rank() function.**
   Program: Consider the schema for Voter Database:
   CONSTITUENCY(cons_id, csname, csstate, no_of_voters)
   PARTY(pid, pname, psymbol)
   CANDIDATES(cand_id, phone_no, age, state, name, pid)
   CONTEST(cons_id, cand_id)
   VOTER(vid, vname, vage, vaddr, cons_id, cand_id)

   Write SQL queries to
   1. List the details of the candidates who are contesting from more than one constituency which are belongs to different states.
   2. Display the state name having maximum number of constituencies.
   3. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg".
   4. Display the constituency name, state and number of voters in each state in descending order using rank() function
   5. Create a TRIGGER to UPDATE the count of "Number_of_voters" of the respective constituency in "CONSTITUENCY" table, AFTER inserting a tuple into the "VOTERS" table.

   **Reference:**
   https://www.youtube.com/watch?v=MSbzErdcb6g
   https://www.youtube.com/watch?v=QFj-hZi8MKk

## Part B

**Mini Project:** For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc. Demonstrate by using front-end tools with reports

**Course Outcomes:**
1. Apply fundamentals of SQL commands to construct a database.
2. Analyze and Design database schema for a given problem domain.
3. Design and implement various databases (Ex. Cricket, Movies etc.)
4. Evaluate nested queries for data manipulation.
5. Design, Develop and Evaluate mini project using modern tools(Like Oracle, MySQL, NetBeans, Eclipse, Apache Tomcat)

## Semester: V
## Course Name: SYSTEM SOFTWARE & OPERATING SYSTEM LAB

| | | | |
|---|---|---|---|
| Course Code | **21CSL57** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Explain the Lexical Analysis and Syntax Analysis phases of Compiler Design.
2. Demonstrate programs on Lexical and Syntax Analysis using LEX & YACC tools.
3. Compare different types of CPU scheduling algorithms used in operating system.
4. Demonstrate the deadlock handling algorithm.
5. Analyze page replacement algorithms for memory management.

## List of Experiments:
## Part A

**Identify the functional requirements, then Design Develop solutions to the problems related to:**

| | |
|---|---|
| **1.** | Write a LEX program to recognize valid arithmetic expression. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately. |
| | Write YACC program to evaluate arithmetic expression involving operators: +, -, *, and / |
| **2.** | Develop, Implement and Execute a program using YACC tool to recognize all strings ending with b preceded by n a's using the grammar an b (note: input n value) |
| **3.** | Design, develop and implement YACC/C program to construct Predictive / LL(1) Parsing Table for the grammar rules: A →aBa , B →bB \| ϵ. Use this table to parse the sentence: abba$ |
| **4.** | Design, develop and implement YACC/C program to demonstrate Shift Reduce Parsing technique for the grammar rules: E →E+T \| T, T →T*F \| F, F → (E) \| id and parse the sentence: id + id * id. |
| **5.** | Design, develop and implement a C/Java program to generate the machine code using ***Triples*** for the statement ***A = -B * (C +D)*** whose intermediate code in three-address form:<br>***T1 = -B***<br>***T2 = C + D***<br>***T3 = T1 + T2***<br>***A = T3*** |
| **6.** | Write a LEX program to eliminate ***comment lines*** in a ***C*** program and copy the resulting program into a separate file.<br>Write YACC program to recognize valid ***identifier, operators and keywords*** in the given text (*C program*) file. |

## Part B

| | |
|---|---|
| **7.** | Design, develop and implement program using any programming language to simulate the working of:<br>1) FCFS<br>2) SJF<br>3) RR<br>4) Priority scheduling algorithm. |
| **8.** | Implement a program using any programming language to demonstrate Banker's algorithm. Assume suitable input required. |
| **9.** | Design and develop a program using any programming language to implement page replacement Algorithms OPTIMAL and FIFO. Assume suitable input required to demonstrate the results. |

**Course Outcomes:**

The student will be able to:-

1. Analyze the programs lexically and syntactically using LEX and YACC tool.
2. Write a program to construct a Predictive parsing table, Shift Reducing parsing technique and machine code for a given grammar.
3. Compare different CPU scheduling techniques used in OS.
4. Design and develop the Banker's algorithm for avoiding deadlock state.
5. Apply the page replacement algorithms for the efficient management of memory.

## Semester: V
## Course Name: Advanced Aptitude

| | | | |
|---|---|---|---|
| Course Code | **21ADA580** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
1. Fundamentals of Mathematics
2. Basic knowledge of Reasoning

**Module – 1: Numerical Ability Based** **03 Hours**

Simplifications, Squares and Square Roots, Cubes and Cube roots, BODMAS Rule, LCM, HCF, Fractions and Decimals

**Module – 2: Percentage Based** **03 Hours**

Percentages, Profit and Loss, Discounts, Simple Interest and Compound Interest

**Module – 3: Time Based** **03 Hours**

Time and Work, Pipes and Cisterns, Time and Distance, Trains, Boats and Streams

**Module – 4: Ratio Based** **03 Hours**

Ratio-proportion, Partnership, Averages and Ages

**Module – 5: Logical and Analytical Based** **03 Hours**

Seating Arrangement, Series, Analogy, Odd man out and Blood Relations

**Course Outcomes:**

**At the end of course students will be able to**
1. Analyze and solve questions based on logical thinking and critical reasoning.
2. Analyze and solve quantitative aptitude problems
3. Solve aptitude problems using fast track techniques
4. Solve puzzle based questions
5. Analyze and solve problems on numerical computation and numerical estimation

## Semester: V
## Course Name: C# AND .NET FRAMEWORK

| | | | |
|---|---|---|---|
| Course Code | **21CS581 / 21AI581** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
**Any Object oriented programming**

**Course objectives:**
1. Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
2. Understand Object Oriented Programming concepts in C# programming language.
3. Interpret Interfaces and define custom interfaces for application.
4. Build custom collections and generics in C#
5. Construct events and query data using query expressions

**Module – 1** **03 Hours**

**Introducing Microsoft Visual C# and Microsoft Visual Studio 2015:** Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions

**Module - 2** **03 Hours**

**Understanding the C# object model:** Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays

**Module – 3** **03 Hours**

Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management

**Module – 4** **03 Hours**

**Defining Extensible Types with C#:** Implementing properties to access fields, Using indexers, Introducing generics, Using collections

**Module – 5** **03 Hours**

Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading

**Course Outcomes:**
1. Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
2. Demonstrate Object Oriented Programming concepts in C# programming language
3. Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
4. Illustrate the use of generics and collections in C#
5. Compose queries to query in-memory data and define own operator behavior

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Microsoft Visual C# Step by Step | John Sharp | PHI Learning Pvt. Ltd | 8th Edition, 2016 |
| **Reference Books** | | | | |
| 1 | C# 6 and .NET Core 1.0 | Christian Nagel | Wiley India Pvt Ltd | 1st Edition 2016 |
| 2 | Essential C# 6.0 | Mark Michaelis | Pearson Education India | 5th Edition, 2016 |
| 3 | Prof C# 5.0 and the .NET 4.5 Framework | Andrew Troelsen | Apress and Dreamtech Press | 6th Edition, 2012. |

## Semester: V
## Course Name: PYTHON PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **21CS582 / 21AI582** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
**Basic Knowledge of Programming**

**Course objectives:**
1. Interpret the basic syntax and semantics of several expressions and functions.
2. Demonstrate the concepts of Iterations and files applied in real world scenario
3. Illustrate the python programs using Strings and Dictionaries.
4. Extend the importance of object oriented programming in python.
5. Implement inheritance concepts to solve real world problems

**Module – 1** **03 Hours**

**Python Basics:** Variables, expressions and statements, Conditional execution, Functions

**Module - 2** **03 Hours**

**Iteration:** While statement, Infinite Loops, definite loops, Loop patterns
**Strings:** String traversal, String Slices, in operator, String methods Format operator
**Files:** Persistence, Opening, reading from text files, using try, except and open, writing to text files

**Module – 3** **03 Hours**

**Lists:** List Operations, slices, methods, lists and functions, list and strings, objects and value, Aliasing, List arguments
**Dictionaries:** Dictionary as a set of counters, Dictionaries and files, Looping and Dictionaries, Advanced text parsing

**Module – 4** **03 Hours**

**Tuples:** Comparing tuples, Tuple assignment, Dictionaries and tuples, Sequences, List comprehension
**Regular Expressions:** Character matching in regular expressions, extracting data using regular expressions, Combining searching and extracting, Escape character

**Module – 5** **03 Hours**

**Classes and objects:** Programmer-defined types, Attributes, Instances as return value, Objects are mutable, Copying
**Classes and functions:** Pure functions, modifiers, prototyping versus planning
**Classes and methods:** Object oriented features, init method, str method, operator overloading, type-based dispatch, polymorphism, Interface and implementation

**Course Outcomes:**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement python data structures to solve real world problems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Python for Everybody: Exploring Data Using Python 3 | Charles R. Severance | CreateSpace Independent Publishing Platform | 1st Edition, 2016 |
| 2 | Think Python: How to Think Like a Computer Scientist | Allen B. Downey | Green Tea Press | 2nd Edition, 2015 |
| **Reference Books** | | | | |
| 1 | Introduction to Computer Science Using Python | Charles Dierbach | CRC Press /Taylor & Francis | 1st Edition,2018 |
| 2 | Programming Python | Mark Lutz | O'Reilly Media | 4th Edition, 2011 |
| 3 | Core Python Applications Programming | Wesley J Chun | Pearson Education India | 3rd Edition, 2015 |

## Semester V
## Course Name: Environmental Studies

| | | | |
|---|---|---|---|
| Course Code | **21ENV59** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |

**Pre-Requisites:**
**Water supply and treatment engineering.**

**Course objectives:**
1. Understand and evaluate the global scale of environmental problems
2. Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world

**Module – 1** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Ecosystems (Structure and Function):** Forest, Desert, Wetlands, Riverine, Oceanic and Lake. **Biodiversity:** Types, Threats and Conservation of biodiversity. Forest Wealth, and Deforestation. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Advances in Energy Systems (Merits, Demerits, Global Status and Applications):** Hydrogen, Solar, OTEC, Tidal and Wind. **Natural Resource Management (Concept and case-studies**): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts,)**: Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Global Environmental Concerns (Concept, policies and case-studies**): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos. |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.IS. & Remote Sensing. Environment Impact Assessment. Environmental Management Systems. |
| **Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, you tube videos. |

**Course Outcomes:**

1. **Understand** the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale. Estimate runoff and develop unit hydrographs.
2. **Develop** critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. **Demonstrate** ecology knowledge of a complex relationship between biotic and a biotic component**.**
4. **Apply** their ecological knowledge to illustrate and graph a problem.
5. Describe the realities that managers face when dealing with complex issues.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**SEE:**

1. The question paper will have 100 questions. Each question is set for 01 marks.
2. The students have to answer 100 multiple choice questions.
3. The duration of the Examination is 02 hours.
4. The final marks will be scaled down to 50 marks.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | **Textbooks** | | | |
| 1 | Environmental Studies | S M Prakash | Pristine Publishing House, Mangalore | 3rd Edition, 2018 |
| 2 | **Environmental Studies** | Benny Joseph | Tata Mc Graw-Hill, 2nd Edition | 2012 |
| 3 | Environmental Studies – From Crisis to Cure R | Rajagopalan | Oxford Publisher | 2005 |
| | | | | |
| 1 | Principals of Environmental Science and Engineering | Raman Sivakumar | Cengage learning, Singapur | 2nd Edition, 2005 |
| 2 | Environmental Science - working with the Earth | G.Tyler Miller Jr. | Thomson Brooks /Cole | 11th Edition, 2006 |
| 3 | Text Book of Environmental and Ecology | Pratiba Sing, Anoop Singh & Piyush Malaviya | Acme Learning Pvt. Ltd. New Delhi. | 1st Edition |

## Semester: V
## Course Name: INTRODUCTION TO DATA STRUCTURES

| | | | |
|---|---|---|---|
| Course Code | **21CS551** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Should have a basic knowledge of C Programming.**

**Course objectives:**
1. Explain the fundamentals of data structures and their applications to solve real life problems.
2. Demonstrate the working of linear and nonlinear data structures.
3. Write solutions to problems using linear data structures and nonlinear data structures.
4. Apply different data structures to solve given problem.
5. Develop skills to apply appropriate data structures in problem solving.

**Module – 1** **08 Hours**

**Introduction:**
Introduction to Data Structures, Types of data structures, data structure operations.
Arrays: one-dimensional arrays, two dimensional arrays, initializing one dimensional and two dimensional arrays, operations on arrays.
**Structures and Unions:** Declaring structures, structure initialization, Introduction to unions
Functions: Built-in functions and user defined functions.

**Module – 2** **08 Hours**

**Linear Data Structures-Stacks and Queues:**
Introduction, Stack representation in Memory, Stack Operations, Stack Implementation, Applications of Stack, Recursion.
Introduction to Queues-Basic concept, Logical representation of Queues, Queue Operations and its types, Queue Implementation, Applications of Queue.

**Module – 3** **08 Hours**

**Linear Data Structures-Linked List:**
Introduction to Pointers: Pointer concepts, accessing variables through pointers, Dynamic memory allocation.
Introduction to Linked list, Logical representation of Linked list, Self-Referential structure, Singly-linked List Operations and its implementation, types of linked lists, introduction to circular linked list.

**Module – 4** **08 Hours**

**Non Linear Data Structures – Trees**
Terminologies, Binary Trees, Properties of Binary trees and representation, Binary Tree Traversal, Binary Search tree and its implementation.

**Module – 5** **08 Hours**

**Non Linear Data Structures –Graphs:** Introduction, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.
**Hashing: I**ntroduction to hashing, Hashing Functions.

**Course Outcomes:**

The student will be able to

1. Identify types of data structures and use them to solve problems
2. Demonstrate the applications of various data structures
3. Apply the data structures to solve problems.
4. Compare solutions of a given problem using different data structures
5. Choose appropriate data structures to solve real world problems

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data structures using C | E Balaguruswamy | McGraw Hill | 2013 Edition |
| 2 | Fundamentals of Data Structures in C | Ellis Horowitz and SartajSahni | Universities Press | 2nd Edition,2014 |
| **Reference Books** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | 2nd Edition, 2014 |

## Semester: VI
## Course Name: INTRODUCTION DATABASE MANAGEMENT SYSTEMS

| | | | |
|---|---|---|---|
| Course Code | **21CS552** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Knowledge of programming
- Data structures

**Course objectives:**
1. Learn and practice data modeling using entity relationship and developing database design
2. Practice SQL programming through a variety of database problems.
3. Apply normalization techniques to normalize the database
4. Demonstrate the use of concurrency and transactions in database
5. Design and build database applications for real world problems.

**Module – 1** **08 Hours**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.
**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

**Module - 2** **08 Hours**

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples
**Mapping conceptual design into a logical design:** Relational database design using ER to relational mapping

**Module – 3** **08 Hours**

**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
**SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database.

**Module – 4** **08 Hours**

**Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

**Module – 5** **08 Hours**

**Normalization: Database Design Theory –** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.
**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

**Course Outcomes:**

1. Demonstrate the basic elements of a relational database management system.
2. Identify the data models for relevant problems.
3. Design ER and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
4. Create, populate and manage relational databases in SQL.
5. Extend normalization for the development of application software

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | Pearson | 7th Edition, 2017 |
| 2 | Database System Concepts | Abraham Silberschatz, Henry F. Korth and S. Sudarshan | Tata Mcgraw Hill Education Private Limited | 6th Edition |
| **Reference Books** | | | | |
| 1 | Database management systems | Ramakrishnan, and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 2 | An Introduction to Database Systems | Christopher J. Date, S. Swamynathan and A. Kannan | Pearson Education | 8th Edition |

## Semester: V
## Course Name: INTRODUCTION TO PYTHON PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | **21CS553** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
Basic Knowledge of Programming
Basic Knowledge of MS word, Excel and PDF

**Course objectives:**
1. Interpret the basic syntax and semantics of several expressions and functions.
2. Demonstrate the concepts of Iterations and files applied in real world scenario
3. Illustrate the python programs using Strings and Dictionaries.
4. Extend the importance of object oriented programming in python.
5. Implement inheritance concepts and File system to solve real world problems

**Module – 1** **03 Hours**

**Python Basics**, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

**Module - 2** **03 Hours**

**Lists,** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods

**Module – 3** **03 Hours**

**Reading and Writing Files,** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger.

**Module – 4** **03 Hours**

**Classes and objects,** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, **Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation

**Module – 5** **03 Hours**

**Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module

**Course Outcomes**

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement python data structures to solve real world problems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Automate the Boring Stuff with Python | Al Sweigart | No Starch Press, | 1st Edition,2015 |
| 2 | Think Python: How to Think Like a Computer Scientist” | Allen B. Downey | Green Tea Press | 2nd Edition, 2015. |
| Reference Books | | | | |
| 1 | Introduction to Python Programming | Gowrishankar S, Veena A | CRC Press /Taylor & Francis | 1st Edition,2018 |

## Semester: V
## Course Name: INTRODUCTION TO OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | **21CS554** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**The students should have the knowledge of:**
- Basics of computer system and its applications
- Basics of computer organization

**Course objectives:**
1. To introduce Operating System, OS responsibilities, and OS services.
2. To discuss process concept, process and scheduling techniques.
3. To demonstrate deadlock condition in the computer system.
4. To introduce memory management and virtual memory management concepts.
5. To explain file system.

**Module – 1** **08 Hours**

**Introduction to operating systems, System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.
**Operating System Services:** User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

**Module - 2** **08 Hours**

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication
**Process Scheduling**: Basic concepts; Scheduling Criteria; Scheduling Algorithms.

**Module – 3** **08 Hours**

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Module – 4** **08 Hours**

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**Module – 5** **08 Hours**

**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Course Outcomes:**

1. Analyze the need of OS, responsibilities of OS, and OS services.
2. Compare different process scheduling techniques.
3. Examine deadlock situation, prevention, avoidance and recovery.
4. Implement virtual memory management concept and page replacement algorithms.
5. Discuss the file system.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley-India | 7th edition, , 2006 |
| **Reference Books** | | | | |
| 1 | Operating Systems: A Concept Based Approach | D.M Dhamdhere | McGraw- Hill | 3rd Ed, , 2013. |

# Scheme of Teaching and Evaluation for

# B.E – VI Semester

# Computer Science & Engg.

# (2021 Scheme)

## Semester: VI
## Course Name: SOFTWARE PROJECT MANAGEMENT

| | | | |
|---|---|---|---|
| Course Code | **21CS61 / 21AI61** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**

**Course objectives:**
1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.

**Module – 1** **08 Hours**

**PROJECT EVALUATION AND PROJECT PLANNING**
Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**Module - 2** **08 Hours**

**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**
Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**Module – 3** **08 Hours**

**ACTIVITY PLANNING AND RISK MANAGEMENT**
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**Module – 4** **08 Hours**

**PROJECT MANAGEMENT AND CONTROL**
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**Module – 5** **08 Hours**

**STAFFING IN SOFTWARE PROJECTS**
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership

**Course Outcomes:**

1. Understand Project Management principles while developing software
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Software Project Management | Bob Hughes, Mike Cotterell and Rajib Mall | Tata McGraw Hill | Fifth and 2011 |
| 2 | Accounting for Management | Jawahar Lal | Wheeler Publications, Delhi | Fifth |
| **Reference Books** | | | | |
| 1 | Effective Software Project Management | Robert K. Wysocki | Wiley Publication | 2011 |
| 2 | Software Project Management | Walker Royce: | Addison-Wesley | 1998 |

## Semester: VI
## Course Name: COMPUTER NETWORKS

| | | | |
|---|---|---|---|
| Course Code | **21CS62** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**The students should have the knowledge of:**
- Basics of communication.
- Basics of computer networks

**Course objectives:**
1. Explain with the basics of data communication and various types of computer networks.
2. Comprehend the transmission techniques (DDC,ADC,DAC)
3. Discuss about router architecture, IP addressing, and routing algorithms in network layer.
4. Introduce the transport layer services and explain the working of UDP and TCP protocols.
5. Demonstrate the working, principles of application layer protocols, and various network security techniques.

**Module – 1** **08 Hours**

**Introduction:** Data Communications, Networks, Network Types, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer:** Data and Signals**,** Digital Signals, Transmission Impairment, Data Rate limits, Performance. **Digital Transmission**: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). Analog to digital conversion (only PCM), Transmission Modes, **Analog Transmission**: Digital to analog conversion.

**Module - 2** **08 Hours**

**Data link control**: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only). **Error Detection and Correction**: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction**. Media Access control**: Random Access, Controlled Access and Channelization

**Module – 3** **08 Hours**

**The Network layer:** Inside a Router, The internet protocol(IP), Datagram format, IPv4 Addressing, Internet Control Message Protocol(ICMP), IPv6, A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast.

**Module – 4** **08 Hours**

**Transport Layer :** Introduction and Transport-Layer Services: Overview of the Transport Layer in the Internet, Multiplexing and De-multiplexing: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.

**Module – 5** **08 Hours**

**Application Layer:** Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Application-Layer Protocols: The Web and HTTP: Overview of HTTP, HTTP Message Format, File Transfer: FTP Commands &Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet\'s Directory Service: Services Provided by DNS, Overview of How DNS Works, Peer-to-Peer Applications: P2P File Distribution

**Network Security:**

Overview of Network Security: Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures , Firewalls and Packet Filtering ,Packet Filtering , Proxy Server .

**Course Outcomes:**

1. Analyze the types of networks.
2. Demonstrate and Compare the transmission techniques.
3. Analyze the router architecture, IP addressing, and routing algorithms in network layer.
4. Categorize the transport layer services and explain the working of UDP and TCP protocols.
5. Apply the working, principles of application layer protocols, and various network security techniques.

**Suggested Learning Resources:**

**Text Books:**

1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5$^{th}$ Edition, Tata McGraw-Hill, 2013.
2. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.
3. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

**Reference Books:**

1. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

## Semester: VI
## Course Name: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| | | | |
|---|---|---|---|
| Course Code | **21CS63** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Data Structures & Algorithms, Theory of probability and statistical analysis**

**Course objectives:**
1. Define machine learning and problems relevant to machine learning.
2. Interpret a wide variety of learning algorithms.
3. Develop an appreciation for what is involved in learning from data.
4. Differentiate supervised, unsupervised and reinforcement learning.
5. Apply performance evaluation parameters (statistical analysis) on learning algorithms, model selection for problems of machine learning.

**Module – 1: Introduction to AI** — **08 Hours**

**AI and Agents:** Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments. The Structure of Agents.
**Search Algorithms:** Hill Climbing, Simulated Annealing, AND-OR Search, The A* approach, AO*, Constraint Satisfaction, Means Ends Analysis.

**Module – 2: Machine Learning & Concept Learning** — **08 Hours**

**Machine Learning:** Well posed learning problems
**Concept Learning**: Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.

**Module – 3: Classification & Prediction** — **08 Hours**

**Classification**: Decision Tree Learning - Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.
**Prediction**: Artificial Neural Network - Introduction, NN representation, Appropriate problems, Perceptron's, Back propagation algorithm.

**Module – 4: Bayesian Learning & Instance based learning** — **08 Hours**

**Bayesian Learning**: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Naive Bayes classifier.
**Instance based learning:** k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function.

**Module – 5: Clustering** — **08 Hours**

Clustering: Overview- Types of clustering, Types of clusters, K-Means, Agglomerative Hierarchical, Clustering, Density-Based Clustering, Graph-Based Clustering, Cluster evaluation.

**Course Outcomes:**

**Students will be able to**

1. Demonstrate the underlying principles of artificial intelligence.
2. Summarize the machine Learning algorithms and their limitations.
3. Applying common machine Learning algorithms in practice and implement on their own.
4. Apply supervised & un-supervised learning algorithms for problem solving.
5. Performing distributed computations using Bayesian learning.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence – A Modern Approach | Stuart Russell & Peter Norvig | Prentice Hall | 3rd Edition, |
| 2 | Machine Learning | Tom. M. Mitchell | McGraw-Hill Science | 1997. |
| 3 | Data Mining: Concepts & Techniques | Jiawei Han & Micheline Kamber, Jian Pei | The Morgan Kaufmann Series | 3rd Edition. |
| **Reference Books** | | | | |
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight and Shivashankar B Nair | McGraw-Hill Education | Third Edition, 2015. |

**Semester: VI**
**Course Name: CLOUD COMPUTING**

| | | | |
|---|---|---|---|
| Course Code | **21CS641 / 21AI641** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Basic Knowledge of Computer Networks
- Basic Knowledge of DBMS
- Python Programming Knowledge

**Course objectives:**
1. To learn various concepts and technologies of clouds.
2. To identify all the available cloud services
3. To understand the design approaches to cloud applications
4. To utilize Hadoop & MapReduce frameworks for developing cloud applications
5. To develop various cloud based applications using python

**Module – 1** **08 Hours**

**Introduction to Cloud Computing:** Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud-based Services & Applications.
**Cloud Concepts & Technologies:** Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring.

**Module - 2** **08 Hours**

**Cloud Concepts & Technologies:** Software Defined Networking, Network Function Virtualization, MapReduce, Identity and Access Management, Service Level Agreements, Billing.
**Cloud Services & Platforms:** Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment & Management Services, Identity & Access Management Services, Open Source Private Cloud Software.

**Module – 3** **08 Hours**

**Hadoop & MapReduce**: Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.
**Cloud Application Design:** Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

**Module – 4** **08 Hours**

**Python for Cloud:** Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure.

**Module – 5** **08 Hours**

**Python for Cloud:** Python for MapReduce, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.
**Cloud Application Development in Python:** Design Approaches, Document Storage App, MapReduce App.

**Course Outcomes:**

**At the end of the course the student will be able to:**

1. Outline the concepts and technologies of clouds.
2. Identify all the available cloud services
3. Analyze the design methodologies of cloud applications
4. Utilize suitable platforms for developing cloud applications
5. Develop cloud various applications using python

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Cloud Computing: A Hands on Approach | Arshdeep Bahga, Vijay Madisetti | ISBN/EAN13: 1494435144/9781494435141 | 2013 |
| **Reference Books** | | | | |
| 1 | Cloud Computing: A Practical Approach for Learning and Implementation | A. Srinivasan, J. Suresh | 1st Edition, Pearson Publications | 2014 |
| 2 | Explain the Cloud Like I'm 10 | Todd Hoff | | 2017 |

## Semester: VI
## Course Name: BLOCKCHAIN TECHNOLOGY

| | | | |
|---|---|---|---|
| Course Code | **21CS642 / 21AI642** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Basic idea of networks
- Basic idea of cloud computing

**Course objectives:**
1. To describe the fundamentals of distributed computing and evaluate the role it plays in blockchain technology.
2. To examine the fundamentals of cryptography and assess how they affect blockchain technology.
3. To assess the advantages, disadvantages, and various uses of blockchain technology.
4. To become familiar with the technology used in Bitcoin
5. To demonstrate proficiency in utilizing the Ethereum platform to develop blockchain applications.

**Module – 1** **08 Hours**

**Blockchain 101:** Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **Decentralization and Cryptography:** Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

**Module - 2** **08 Hours**

**Introduction to Cryptography & Cryptocurrencies:** Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency.
**How Bitcoin Achieves Decentralization:** Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together

**Module – 3** **08 Hours**

**Mechanics of Bitcoin:** Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.
**How to Store and Use Bitcoins:** Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

**Module – 4** **08 Hours**

**Bitcoin Mining:** The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.
**Bitcoin and Anonymity:** Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash

**Module – 5** **08 Hours**

**Smart Contracts and Ethereum 101:** Smart Contracts: Definition, Ricardian contracts. **Ethereum 101:** Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

**Course Outcomes:**

**The student should be able to**

1. Interpret the principles of Distributed computing and analyze its significance in Blockchain technology.
2. Analyze the principles of Cryptography and evaluate its impact on Blockchain technology.
3. Evaluate the benefits, drawbacks, and diverse applications of Blockchain technology
4. Impart the technologies involved in Bitcoin
5. Utilize the Ethereum platform to develop blockchain applications

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained | Imran Bashir | Packt Publishing Ltd, Second Edition | 2017 |
| 2 | Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction | Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark | Princeton University Press | 2016 |
| **Reference Books** | | | | |
| 1 | Mastering Bitcoins: Unlocking Digital Cryptocurrencies | Andreas Antonopoulos | O'Reilly Media, Inc | 2013 |

## Semester: VI
## Course Name: NATURAL LANGUAGE PROCESSING

| | | | |
|---|---|---|---|
| Course Code | **21CS643 / 21AI643** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Knowledge of Python, Data Structures & Algorithms**

**Course objectives:**
1. Introduce the fundamental techniques of natural language processing.
2. Analyze the natural language text.
3. Describe types of classifiers used for text classification.
4. Understand the concepts of Text mining.
5. Illustrate information retrieval techniques.

**Module – 1** **08 Hours**

**Introduction to NLP**
NLP in real world, NLP tasks, Language – Building Blocks of Language, NLP challenges, Machine Learning, Deep Learning and NLP overview, Approaches to NLP – Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP
**NLP Pipeline**
Generic NLP pipeline, Data Acquisition,

**Module - 2** **08 Hours**

**NLP Pipeline**
Text Extraction and Clean up – Normalization, Spelling Correction, System Specific Error Correction, Preprocessing – Word Tokenization, Stemming and Lemmatization
**Text Representation**
Vector Space Model, Bag of words, N – gram, TF – IDF, Word Embedding's – Continuous bag of words (CBOW), Skip Gram.

**Module – 3** **08 Hours**

**Text Classification**
Naïve Bayes classifier, Logistic Regression, Support Vector Machine, CNNs and LSTMs for Text Classification, Case study – Corporate Ticketing

**Module – 4** **08 Hours**

**Information Extraction (IE)**
IE Applications, IE Tasks, Pipeline for IE, Key phrase Extraction, Named Entity Recognition (NER) – Building and NER system, NLP using Active Learning, Dis-ambiguity and Linking Relationship Extraction - Approaches to RE

**Module – 5** **08 Hours**

**Chat bots**
A simple FAQ chat bots, Taxonomy of chat bots – Goal oriented Dialog, Chit chats, Pipeline for building dialog systems, Components of Dialog system – Dialog Act classification, identifying slots, Response Generation, End – to – End approach, Deep Reinforcement Learning for Dialog Generation, Human – in – the – Loop.

**Course Outcomes:**

The student will be able to-

1. Apply hidden Markov models, and word embeddings to implement autocorrect, auto complete and identify part-of-speech tags for words.
2. Apply logistic regression and naïve Bayes to implement NLP applications that perform sentiment analysis.
3. Illustrate word vectors to complete analogies and translate words.
4. Demonstrate the concepts of neural networks, LSTM, GRUs for sentiment analysis, text generation and named entity recognition.
5. Design NLP applications that perform question-answering and create tools to translate languages and even build chat bots.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems | Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana | OReilly | 1st Edition, 2020 |
| **Reference Books** | | | | |
| 1 | Natural Language Understanding | James Allen | Pearson Education | |
| 2 | Speech and Language Processing | Jurafsky Dan & Martin James H | Prentice Hall | 3rd Edition, 2023 |
| 3 | Natural Language Processing and Information Retrieval | Tanveer Siddiqui, U.S. Tiwary | Oxford University Press | 2008 |
| 4 | Natural Language Processing with Python | Steven Bird, Ewan Klein & Edward Loper | OReilly Media | 1st Edition, 2009 |
| 5 | Foundations of Statistical Natural Language Processing | Christopher D Manning & HinrichSchutze | MIT Press | 1999 |
| **Links** | | | | |
| 1 | https://nptel.ac.in/courses/106/105/106105158/ | | | |
| 2 | http://www.nptelvideos.in/2012/11/natural-language-processing.html | | | |

## Semester: VI
## Course Name: COMPUTER NETWORKS LAB

| | | | |
|---|---|---|---|
| Course Code | **21CSL66** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**
1. Demonstrate operation of network simulator (NS3) and its management commands
2. Simulate and demonstrate the performance of bus, star, and congestion window.
3. Implement the network and transport layer protocols.
4. Demonstrate the error detection techniques to detect the errors and cryptographic techniques for providing security.
5. Implement socket programming using TCP/UDP.

## List of Experiments:
## Part A

**Identify the requirements, then design and develop solutions in NS3:**
1. Installation of NS3 & configuration of NetAnim software.
2. Implement two nodes **point – to – point** network with duplex links between them. vary the data rate & delay to see the output on NetAnim
3. Implement Bus topology.
4. Implement Star topology.
5. Implement LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
6. Implement a hybrid topology by connecting multiple routers and nodes.

## Part B
### Implement the programs based on the following concepts (using Java/python)
7. Error detection mechanism.
8. Shortest path between the source and destination.
9. TCP/IP socket programming.
10. UDP socket programming.
11. Encryption and decryption of the data
12. Congestion control algorithm.

**Course Outcomes:**
1. Analyze the networking concepts in NS3 simulator
2. Apply star, bus, hybrid topologies' concepts to simulate a network using NS3 simulator.
3. Implement the network layer and transport layer algorithms like link state and leaky bucket algorithm.
4. Evaluate the error detection techniques to detect the errors and cryptographic techniques for providing security.
5. Design and develop an application for client/server architecture using TCP and UDP.

## Semester: VI
## Course Name: AI & ML Lab

| | | | |
|---|---|---|---|
| Course Code | **21CSL67** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Course objectives:**

1. Define machine learning and problems relevant to machine learning.
2. Interpret a wide variety of learning algorithms.
3. Develop an appreciation for what is involved in learning from data.
4. Differentiate supervised, unsupervised and reinforcement learning.
5. Apply performance evaluation parameters (statistical analysis) on learning algorithms, model selection for problems of machine learning.

## List of Experiments:
## Part A

**Identify the functional requirements, then Design Develop solutions to the problems related to:**

1. Implement **Find S algorithm**.
2. Implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the **decision tree based ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Implement the concept of Random Forest.
5. Build an Artificial Neural Network by implementing the **Back propagation algorithm** and test the same using appropriate data sets.
6. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.
7. Demonstrate the working of SVM Classifier
8. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
9. Apply **EM algorithm** to cluster a set of data. Use the same data set for clustering using **k-Means algorithm.** Compare the results of these two algorithms and comment on the quality of clustering.
10. Demonstrate the working of Density Based Clustering (DB Scan Algorithm)

**Course Outcomes:**

1. Identify and Apply Artificial Intelligence & machine learning concepts to solve real world problems of moderate complexity.
2. Apply the fundamentals of concept learning for various problems/applications.
3. Apply basic rules of Bayes theorem.
4. Solve problems using appropriate supervised, unsupervised algorithms.
5. Perform experiments in Machine Learning using real-world data.

## Semester: VI
## Course Name: MINI PROJECT

| | | | |
|---|---|---|---|
| Course Code | **21MN68** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:4** | SEE Marks | **50** |
| Credits | **2** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Mini-Project Work:**
Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

**CIE procedure for Mini-project:**

i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the **project report, project presentation skill, and question and answer session** in the ratio of **50:25:25**. The marks awarded for the project report shall be the same for all the batches mates.

ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the **project report, project presentation skill, and question and answer session** in the ratio **50:25:25**. The marks awarded for the project report shall be the same for all the batch mates.

## Semester: VI
## Course Name: COMPUTER GRAPHICS USING OPENGL

| | | | |
|---|---|---|---|
| Course Code | **21CS69A** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**Pre-Requisites:**
1. Basic operations of vectors and matrices.
2. Basic concepts of 2-D computer graphics.
3. Good programming skills in C or C++

**Course objectives:**
1. Apply the mathematical concepts and fundamentals of computer graphics to visualize objects in the computer
2. Examine the coordinate systems of computer graphics
3. Evaluate 2D, 3D transformation of objects
4. Determine process of plotting objects using graphics library toolkit
5. Interpret and animated solution to solve real world problems

**Design, develop, and implement the following programs using OpenGL API**
1. Implement different Geometrical Primitives using various types of Symbolic Constants in OpenGL
2. Implement Brenham's line drawing algorithm for all types of slope.
   Refer: Text-1: Chapter 3.5
   Refer: Text-2: Chapter 8
3. Create and rotate a triangle about the origin and a fixed point.
   Refer: Text-1: Chapter 5-4.
4. 3. Draw a color cube and spin it using OpenGL transformation matrices.
   Refer: Text-2: Modelling a Colored Cube.
5. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing.
   Refer: Text-2: Topic: Positioning of Camera.
6. Clip a lines using Cohen-Sutherland algorithm
   Refer: Text-1: Chapter 6.7
   Refer: Text-2: Chapter 8
7. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
   Refer: Text-2: Topic: Lighting and Shading
8. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user.
   Refer: Text-2: Topic: sierpinski gasket.
9. Develop a menu driven program to animate a flag using Bezier Curve algorithm
   Refer: Text-1: Chapter 8-10
10. Develop a menu driven program to fill the polygon using scan line algorithm
    Refer: Text-1: Chapter 2

**Course Outcomes**

1. Apply the concepts of computer graphics
2. Implement computer graphics applications using OpenGL
3. Implement real world problems using OpenGL

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer Graphics-OpenGL | Donald Hearn & Pauline Baker | Pearson Education | 2011 |
| 2 | OpenGL Programming Guide | Dave Shriner | Pearson Education | 2010 |
| **Reference Books** | | | | |
| 1 | Interactive computer graphics- A Top Down approach with OpenGL | Edward Angel | Pearson Education | 2011 |
| 2 | Computer Graphics using OpenGL Fillip Learning | M MRaikar | Elsevier | 2013 |

## Semester: VI
## Course Name: MOBILE APPLICATION DEVELOPMENT

| | | | |
|---|---|---|---|
| Course Code | **21CS69B** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P:S) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites:**
- **Knowledge of JAVA programming**

**Course objectives:**
1. To understand the architecture and components of android application
2. To design interactive user interface
3. To design interface using Specialized Fragments
4. To work with SQLite database
5. To develop an Android Application to solve real world problems

**Module – 1** **03 Hours**

**Getting Started with Android Programming:** Android, Features of Android, Android Architecture, obtaining the required tools, launching your first android application.

**Module - 2** **03 Hours**

**Activities, Fragments and Intents:** Understanding activities, linking activities using intents, fragments

**Module – 3** **03 Hours**

**Getting to know the Android User Interface:** Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView

**Module – 4** **03 Hours**

**Designing User Interface with Views:** TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews, ProgressBar View, AutoCompleteTextView View, TimePicker View, DatePickerView, ListView View, SpinnerView

**Module – 5** **03 Hours**

**Understanding Specialized Fragments:** List Fragment, DialogFragment, PreferenceFragment
**Creating and using Databases:** Creating the DBAdapter Helper class, using the database programmatically

**Course Outcomes:**
1. Understand various application components in android.
2. Design efficient user interface using different layouts.
3. Develop application using Specialized Fragments
4. Develop application with persistent data storage using SQLite
5. Develop an interactive applications using android studio

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Beginning Android Programming with Android Studio | J. F. DiMarzio | 4thEdition | 2017 |
| **Reference Books** | | | | |
| 1 | Android Programming for Beginners | John Horton | 1stEdition | 2015 |
| 2 | Head First Android Development | Dawn Griffiths & David Griffiths | O'Reilly, 1stEdition | 2015 |

**Semester: VI**
**Course Name: ROBOTIC PROCESS AUTOMATION**

| | | | |
|---|---|---|---|
| Course Code | **21CS69C** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-Requisites: Basic Programming Concepts**

**Course objectives:**
At the end of the course, the student will be able to
1. Outline the basic concepts of RPA.
2. Understand the various components of RPA, where it can be applied and how it implemented
3. Describe the different types of variables, Control Flow and data manipulation techniques
4. Model the workflow of various control techniques and OCR in RPA
5. Interpret use of exception handling techniques to handle the log errors.

**Module – 1** **03 Hours**

**RPA Foundations**:
What is RPA – Flavors of RPA- **History of RPA-** The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- OCR-Databases-APIs- AI-Cognitive Automation-Agile, Scrum, Kanban and Waterfall DevOps- Flowcharts.

**Module - 2** **03 Hours**

**RPA Platforms**:
Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio - Task recorder - Step-by- step examples using the recorder.

**Module – 3** **03 Hours**

**Sequence, Flowchart, and Control Flow**:
Sequencing the workflow- Activities - Control flow, various types of loops, and decision making-Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope- Collections-Arguments – Purpose and use-Data table usage with examples-Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).

**Module – 4** **03 Hours**

**Taking Control of the Controls**:
Finding and attaching windows- Finding the 08 control- Techniques for waiting for a control- Act on controls – mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping-When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.

**Module – 5** **03 Hours**

**Exception Handling:**
Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting.

**Course Outcomes:**

**The student should be able to:**

1. Discuss the fundamental & basic principles of Robotic Process Automation, Applications in various industries.
2. Summarize the various components & Platforms of RPA.
3. Analyze the different types of variables, control flow and data manipulation techniques.
4. Apply various control techniques and OCR in RPA
5. Design and develop a bot to capture runtime exception & handling of such type of exceptions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems | Tom Taulli | A press | 2020, ISBN-13 (electronic): 978-1-4842-5729-6 |
| 2 | Learning Robotic Process Automation | Alok Mani Tripathi | Packt Publishing | March 2018 ISBN: (electronic): 9781788470940 |
| **Reference Books** | | | | |
| 1 | Introduction to Robotic Process Automation: a Primer | Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston | Institute of Robotic Process Automation | |
| 2 | Richard Murdoch | Robotic Process Automation: Guide To Building Software Robots | Automate Repetitive Tasks & Become An RPA Consultant | |

## Semester: VI
## Course Name: PROGRAMMING IN JAVA

| | | | |
|---|---|---|---|
| Course Code | **21CS651** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
**Students should know the basic knowledge on:**
- C Programming
- C++

**Course objectives:**
1. Learn fundamental features of object oriented language and JAVA.
2. To create, debug and run simple Java programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object Oriented concepts.

**Module – 1** **08 Hours**

**Introduction to Java**: Java's magic: The Bytecode, The Java Buzzwords.
**An Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Lexical Issues.
**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.

**Module - 2** **08 Hours**

**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.
**Control Statements:** Java's Selection Statements, Iteration Statements, Jump Statements.

**Module – 3** **08 Hours**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class.
**A Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

**Module – 4** **08 Hours**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces.
**Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

**Module – 5** **08 Hours**

| |
|---|
| **Enumerations:** Enumerations.<br>**I/O**: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files, Automatically Closing a File.<br>**String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder. |

**Course Outcomes:**

1. Identify classes, objects, members of a class and relationship among them needed for a specific problem.
2. Develop JAVA application programs using control statements.
3. Implement reusability Programs in JAVA using inheritance.
4. Develop JAVA Programs of error handling techniques using exception handling.
5. Demonstrate string handling concepts using JAVA.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8th Edition,2015 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balagurusamy | Tata McGraw Hill | |

## Semester: VI
## Course Name: INTRODUCTION TO DATA ANALYTICS

| | | | |
|---|---|---|---|
| Course Code | **21CS652** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**
- Basic Knowledge of DBMS
- Basic Knowledge of Microsoft Excel

**Course objectives:**
1. To learn various concepts and technologies of Data Analytics
2. To discuss the various OLTP system characteristics
3. To discuss the various aspects related to the Data lake and Data warehouse
4. To present the data using various Visualization tools

**Module – 1** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Module - 2** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Module – 3** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Module – 4** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Module – 5** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
**Advanced data visualization**- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply the BI concepts to solve real life problems.
2. Design OLTP techniques to provide business solutions
3. Apply BI techniques to design a data lake.
4. Analyze data using various data visualization techniques.
5. Analyze trends using advanced data visualization techniques.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: VI**

**Course Name: Introduction to Artificial Intelligence & Machine Learning**

| | | | |
|---|---|---|---|
| Course Code | **21CS653** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**

**Knowledge of Mathematics & Data Structures and Algorithms**

**Course objectives:**

1. Understands the basics of AI, history of AI and its foundations, basic principles of AI for problem solving.
2. Compare and contrast different AI techniques available.
3. Define and explain learning algorithms
4. Explore the basics of Machine Learning & Machine Learning process, understanding data
5. Understand the Working of Artificial Neural Networks.

**Module – 1** **08 Hours**

**Introduction:** What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents.

**Module - 2** **08 Hours**

**Problem solving by searching:** Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions

**Module – 3** **08 Hours**

**Introduction to machine learning:** Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.

**Understanding Data:** What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization.

**Module – 4** **08 Hours**

**Understanding Data:** Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,

**Basics of Learning Theory:** Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.

**Similarity-based learning:** Introduction to Similarity or instance based learning, Nearest-neighbour learning, weighted k- Nearest - Neighbour algorithm.

**Module – 5** **08 Hours**

**Artificial Neural Network:** Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Design intelligent agents for solving simple gaming problems.
2. Apply techniques to solve the AI problems
3. Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning
4. Understand data and applying machine learning algorithms to predict the outputs.
5. Model the neuron and Neural Network, and to analyze ANN learning and its applications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence A Modern Approach | Stuart Russel, Peter Norvig | Pearson Education | 3rd Edition, 2015 |
| 2 | Machine Learning | S. Sridhar, M Vijayalakshmi | Oxford | 2021 |
| **Reference Books** | | | | |
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3rd Edition, 2009 |
| 2 | Principles of Artificial Intelligence | Nils J. Nilsson | Elsevier | 1980 |

## Semester: VI
## Course Name: INTRODUCTION TO CYBER SECURITY

| | | | |
|---|---|---|---|
| Course Code | **21CS654** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-Requisites:**

**The students should have the knowledge of:**

- Awareness about the loopholes/drawbacks of the advanced technologies on which the society is dependent.
- Awareness about the crimes being done through technology.

**Course objectives:**

1. To familiarize the cybercrime terminologies and perspectives.
2. To illustrate the phases of cybercrime plan and different types of cybercrimes.
3. To gain the knowledge about the tools and methods used by the criminals.
4. To reveal the techniques used in phishing and identity theft.
5. To emphasize the necessary of computer and cyber forensics.

**Module – 1** **08 Hours**

**Introduction to Cybercrime:**
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**Module - 2** **08 Hours**

**Cyber Offenses:**
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

**Module – 3** **08 Hours**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

**Module – 4** **08 Hours**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

**Module – 5** **08 Hours**

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**Course Outcomes:**
1. Identify the various terminologies being used in cybercrime.
2. Categorize the types of cybercrimes.
3. Illustrate the tools and methods used by criminals for cybercrime.
4. Compare the various techniques used in phishing and identity theft.
5. Utilize various cyber security techniques including cyber forensics.

**Suggested Learning Resources:**

**Text Books:**
1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

**Reference Books:**
2. Neil Daswani, Moudy Elbayadi Big Breaches: “Cyber-security Lessons for Everyone”, Feb 2021

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# Scheme of Teaching and Evaluation for
# B.E – V & VI Semester
# Electronics & Comm. Engg.
# (2021 Scheme)

**Scheme of Teaching and Evaluation for B.E Program**

# Electronics & Communication Engineering

**With effect from the Academic Year 2021-22**
**Total Credits for B.E.: 160**
**Credits Distribution as per NEP 2020**

## Semester 5

| SN | Course category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| **01** | PCC | 21EC51 | Communication Systems-II | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **02** | PCC | 21EC52 | Electromagnetic Theory | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **03** | PCC | 21EC53 | Microcontrollers & Embedded Systems | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **04** | PE | 21EC54X | Professional Elective-1 | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **05** | OE | 21EC55X | Open Elective - 1 | Other departments offering the course | Other departments offering the course | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **06** | PCC | 21ECL56 | Communication Laboratory-II | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| **07** | PCC | 21ECL57 | Microcontrollers & Embedded System Lab | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| **08** | AEC | 21ADA580 | Advanced Aptitude | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| **09** | AEC | 21AEC581 | LINUX Fundamentals | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 2 | 50 | 50 | 100 |
| **10** | HS | 21ENV59 | Environmental Studies | Humanities | Humanities | 1 | 0 | 0 | 1 | 2 | 50 | 50 | 100 |
| | | **Total** | | | | | | | **20** | | **500** | **500** | **1000** |

### Professional Elective – 1

| | | |
|---|---|---|
| 01 | 21EC541 | C++ and Data Structures |
| 02 | 21EC542 | Computer Organization and Architecture |
| 03 | 21EC543 | Operating Systems |
| 04 | 21EC544 | Sensors and actuators for Engineering Applications |

Professional Elective Courses (PE): A professional elective (PE) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum students' strength for offering professional electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

### Open Elective -1

| | | |
|---|---|---|
| 01 | 21EC551 | Introduction to Computer Networks |
| 02 | 21EC552 | Information Theory and Coding |
| 03 | 21EC553 | Linear Integrated Circuits and Applications |
| 04 | 21EC554 | Principles of Analog and Digital Communication |

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.

# Semester 6

| SN | Couse category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| **01** | HS | 21EC61 | Management and Entrepreneurship | Humanities /Concerned Department | Humanities /Concerned Board | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| **02** | PCC | 21EC62 | Microwaves and Antennas | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **03** | PCC | 21EC63 | Fundamentals of VLSI Design | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **04** | PE | 21EC64X | Professional Elective – 2 | Concerned Department | Concerned Board | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **05** | OE | 21EC65X | Open Elective - 2 | Other departments offering the course | | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| **06** | PCC | 21ECL66 | Microwaves and Antennas Laboratory | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| **07** | PCC | 21ECL67 | VLSI Lab | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| **08** | PW | 21MN68 | Mini Project | Concerned Department | Concerned Board | Two contact hours /week for interaction between the faculty and students | | | 2 | 3 | 50 | 50 | 100 |
| **09** | AEC | 21AEC690 | Internet of Things Laboratory | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 2 | 50 | 50 | 100 |
| **10** | INT | 21INT691 | Summer Internship-II | Completed during the intervening period of IV and V semesters. | | | | | 2 | --- | 100 | - | 100 |
| | | | | | | | | **Total** | **22** | | **550** | **450** | **1000** |

## Professional Elective – 2

| | | |
|---|---|---|
| **01** | **21EC641** | **Machine Learning with Python** |
| **02** | 21EC642 | Real Time Operating Systems |
| **03** | 21EC643 | Speech Signal Processing |
| **04** | 21EC644 | Research Methodology & IPR |

## Open Elective -2

| | | |
|---|---|---|
| **01** | **21EC651** | **Internet of Things** |
| **02** | 21EC652 | Embedded System Design |
| **03** | 21EC653 | Digital Image Processing |
| **04** | 21EC654 | Fundamentals of CMOS VLSI Technology |

## Internship – II (21INT691):

All the students admitted to engineering programmes shall have to undergo a mandatory internship-II of 04 weeks during the intervening vacation of IV and V semesters.

All the students TAKING FAST TRACK /SUPPLEMENTARY SEMESTER shall have to undergo a mandatory internship-II of 04 weeks during the intervening period of V and VI semesters. Internship-II shall include Innovation/ Entrepreneurship / Societal based Internship. A Viva-voce examination (Presentation followed by question-answer session) shall be conducted during VI semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examinations after satisfying the internship requirements The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.

# Scheme of Teaching and Evaluation for

# B.E – V Semester

# Electronics & Comm. Engg.

# (2021 Scheme)

## Semester: V
## Course Name: Communication Systems-II

| | | | |
|---|---|---|---|
| Course Code | 21EC51 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:** Digital Signal Processing, Communication Theory- I

**Course objectives:**

- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Understand the principles of spread spectrum communications.
- Understand the basic principles of information theory and various source coding techniques.
- Build a comprehensive knowledge about various Source coding techniques.
- Discuss the different types of errors and error detection and controlling codes used in the communication channel.
- Understand the concepts of convolution codes and analyze the code words using time domain and transform domain approach.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Digital Modulation Techniques:** Phase shift Keying Techniques using coherent detection: Generation, detection and error probabilities of Binary Phase shift Keying (BPSK), QPSK, Frequency shift keying techniques using Coherent detection: Generation, detection and error probabilities of Binary Frequency shift Keying (BFSK). **Non Coherent Orthogonal Modulation Techniques:** Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error of BFSK and DPSK, (without derivation of probability of error equation) **(Text 1: 7.8, 7.9, 7.11, 7.15, 7.16).** |
| **Teaching-Learning Process:** Chalk and talk method, Simulation of modulation techniques, Power Point Presentation, YouTube videos Animation of BASK, BPSK, QPSK, BFSK and DPSK. Problems on Generation and detection of DPSK, QPSK. |
| **Self-study topic:** Minimum shift keying and Non-coherent BFSK |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Signaling Over AWGN Channels-** Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. **(Text 1: 7.1,7.2,7.5)** |
| **Principles of Spread Spectrum:** Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum **(Text 2:10.3.1 to 10.3.6)** |
| **Teaching-Learning Process:** Chalk & talk method, PowerPoint Presentation, YouTube videos |
| **Self-Study Topics:** Maximum Likelihood detection, Channel equalization |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Introduction to Information Theory:** Measure of information, Average information content of symbols in long independent sequences (Text 3: 4.1, 4.2.1, 4.2.2) **Source Coding:** Encoding of the Source Output, Source coding theorem, Shannon’s Encoding Algorithm (Text 3: 4.3), Shannon-Fano Encoding Algorithm, Huffman Encoding **(Text 1: 9.5)** |
| **Teaching-Learning Process:** Chalk and talk method, Problems on source coding, error control codes |
| **Self-Study Topics:** Properties of Codes, Kraft McMillan Inequality property, Lempel-Ziv Coding |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| | |
|---|---|
| **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, and types of Codes. **(Text 3:9.1.1 to 9.1.4)** **Linear Block Codes:** Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. **(Text 3: 9.2)** | |
| **Teaching-Learning Process:** Chalk and talk method, Problems on source coding, error control codes | |
| **Self-Study Topic:** Discrete memoryless channels | |

**Module – 5** **08 Hours (RBT Levels: L1,L2 & L3)**

| | |
|---|---|
| **Binary Cyclic Codes:** Algebraic structure of Cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation, Error Detection and Correction. **(Text 3: 9.3.1, 9.3.2, 9.3.3)** **Convolution Codes:** Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram. **(Text 1: 8.5, 8.6, 8.9)** | |
| **Teaching-Learning Process:** Chalk and talk method, Animation of convolution encoders. | |
| **Self-Study Topic:** Bose Chaudhuri Hocquenghem (BCH), Reed Solomon (RS) codes | |

**Course Outcomes:**

1. Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications.
2. Interpret the principles of spread spectrum communications
3. Apply the fundamentals of information theory and perform source coding for given message.
4. Analyze the importance of error detection and capabilities of linear block codes for controlling errors.
5. Design the different encoding and decoding techniques for cyclic codes and convolution codes.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Communications | Simon Haykins | John Wiley | 2021 |
| 2 | Fundamentals of Communication Systems | John G Proakis and Masoud Salehi | Pearson Education | 2001 |
| 3 | Digital and Analog Communication Systems | K Sam Shanmugan | John Wiley | 1996 |
| **Reference Books** | | | | |
| 1 | Modern Digital and Analog Communication Systems | B. P. Lathi and Zhi Ding | Oxford University Press | |
| 2 | Concepts of Information Theory and Coding | P. S. Satyanarayana, | Dynaram | 2005 |
| 3 | Information Theory and Coding | Hari Bhat and Ganesh Rao | Cengage | 2017 |

**e-Resources:**

“Digital Communication”, John R. Barry, Edward A. Lee, David G. Messerschmitt.
“Communication Systems”, Simon Haykin, 4th Edition.

**MOOCs:**

NPTEL lecture series: Prof Bikas Kumar Dey, IIT Bombay.
NPTEL lecture series: Digital Communications, IIT Madras.

## Semester: V
## Course Name: Electromagnetic Theory

| | | | |
|---|---|---|---|
| Course Code | 21EC52 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:**
Fundamental physics, Vector calculus, Integral and differential calculus.

**Course objectives:**
This Theory course enables students to

- **Understand Electromagnetic Fundamentals:** Develop a comprehensive understanding of the fundamental concepts and principles of electromagnetism, including electric and magnetic fields, charge distributions, and Maxwell's equations.
- **Analyze Static Electric and Magnetic Fields:** Apply mathematical techniques and fundamental principles to analyze static electric and magnetic fields. Understand the behavior of electric and magnetic fields in different materials and configurations.
- **Study Time-Varying Fields and Maxwell's Equations:** Analyze time-varying electric and magnetic fields and their relationship to Maxwell's equations. Understand the role of displacement current and the propagation of electromagnetic waves.
- **Investigate Electromagnetic Waves:** Study the characteristics, properties, and behavior of electromagnetic waves in different media. Analyze the generation, transmission, and reception of electromagnetic waves.
- **Develop Problem-Solving and Analytical Skills:** Develop problem-solving skills by applying mathematical and analytical techniques to solve complex electromagnetic problems. Enhance critical thinking and analytical abilities through analysis and interpretation of electromagnetic phenomena.
- **Research and Analytical Abilities:** Cultivate research skills by studying and reviewing scientific literature related to electromagnetic theory. Develop the ability to analyze and critically evaluate research findings in the field.
- **Enhance Communication and Presentation Skills:** Improve written and oral communication skills through technical report writing and presentation of electromagnetic theory concepts, experiments, and research findings.

**Module – 1** **10 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Prerequisites:** Review of Vector Algebra, Vector Calculus, Coordinate Systems and Coordinate transformations. **(Only for CIE) (Text 2: 1.1-1.8, 2.1-2.4, 3.1-3.4)**<br>Coulomb's Law and Electric Field Intensity: Experimental law of Coulomb (Vector form), Electric field intensity, Field due to finite charge distributions, Field due to infinite line charge and infinite Sheet of charge, Numerical Problems. **(Text 1: 2.1-2.5)** |
| **Gauss's Law and Its Applications:** Electric flux density, Gauss law (Statement and Proof), Applications of Gauss law, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), divergence theorem, Numerical Problems **(Text 1: 3.2 to 3.7)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving, Conceptual Demonstration through Simulation tools (HFSS/MATLAB) |
| **Self-Study Topics:** Difference between Circuit theory and Electromagnetic field theory |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Energy, Potential and Conductors:** Energy expended or work done in moving a point charge in an electric field, Definition of potential difference and potential, The potential difference due to point charge and system of charges, Potential gradient, Numerical Problems. **(Text 1: 4.1 to 4.4 and 4.6)**<br>Current and Current density, Continuity of current equation. **(Text 1: 5.1, 5.2)**<br>Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Numerical problems on Laplace equation, Capacitance calculation for different configurations using Laplace's equation, Uniqueness theorem. **(Text 1: 7.1to 7.3)** |
| **Teaching-Learning Process:** Chalk and talk method, Power Point Presentation, YouTube videos, Problem solving. |
| **Self-Study Topics:** Energy density, Applications of Poisson's equation |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Steady Magnetic Fields:** Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Concept of Scalar and Vector Magnetic Potentials, Numerical problems. **(Text 1: 8.1to 8.6)**<br>**Magnetic Forces:** Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Numerical problems. **(Text 1: 9.1 to 9.3)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving. |
| **Self Study Topics:** Magnetic Materials/Circuits, Mutual Inductance. Magnetic Energy Storing issues. |

**Module – 4** **07 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Time Varying Fields and Maxwell's equations:** Faraday' law of Electromagnetic Induction – Integral form and Point form, Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems. **(Text 1: 10.1 to 10.4)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving. |
| **Self Study Topics:** History of Maxwell's equations, Hertz experiments, EM radiation phenomena. |

**Module – 5** **07 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Uniform Plane Waves:** Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media ($\gamma$, $\alpha$, $\beta$, $\eta$) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text 1: 12.1to 12.4)**<br>**Electromagnetic Compatibility (EMC):** Introduction, Goals and importance of EMC, Applications of EMC. **(Web Link 3)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem Solving, Demonstration through Simulation tools (HFSS/MATLAB). |
| **Self Study Topics**: Polarization of electromagnetic waves, phase velocity, and group velocity, Electromagnetic Interference (EMI). |

**Course Outcomes:**

At the end of the course the student will be able to:

1. **Solve** problems on Electric force, electric field intensity due to point, linear, volume charges by applying Coulombs Law and Gauss's Law.
2. **Determine** Energy and Potential for various charge distributions and apply continuity equation of current to calculate flow of current, total charge, charge density etc. for Conductors.
3. **Apply** Poisson's and Laplace equations for solving boundary value problems associated with electrostatics and magneto-statics.
4. **Analyze** the applications of magneto-statics by applying Biot-Savart law, Ampere's circuital law and derive the concepts of magnetic forces and materials to characterize the magnetic circuits.

5. **Analyze** Maxwell's equations for Static fields, time varying fields, EM waves in free space, conductors and Evaluate power associated with EM waves using Poynting theorem.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Engineering Electromagnetics | William H. Hayt, John A. Buck, M. Jaleel Akhtar | Tata McGraw- Hill | 8th Edition, 2014. |
| 2 | Elements of Electromagnetics | Matthew N. O. Sadiku | Oxford Niv. Press | 4th Edition |
| **Reference Books** | | | | |
| 1 | Electromagnetic Waves and Radiating Systems | E.C. Jordan and K. G. Balmain | PHI | 2nd Edition, 2000 |
| 2 | Engineering Electromagnetics | Nathan Ida, | Springer (India) Pvt. Ltd., New Delhi | 2nd Edition, 2005 |
| 3 | Electromagnetics- Schaum's Outline series | Joseph A. Ediminister | Tata McGraw-Hill | Revised 2nd Edition, 2014 |
| **e-Resources/ Web Links** | | | | |
| 1 | https://nptel.ac.in/courses/108/106/108106073/ | | | |
| 2 | https://nptel.ac.in/courses/117/103/117103065/ | | | |
| 3 | https://archive.nptel.ac.in/courses/108/106/108106138/ | | | |

## Semester: V
## Course Name: Microcontrollers & Embedded Systems

| | | | |
|---|---|---|---|
| Course Code | 21EC53 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:**
1. Knowledge about CPU, Memory and I/O.
2. Fundamentals of Digital Electronics.
3. Programming fundamentals of C – language.

**Course objectives:**
1. Understand the difference between a Microprocessor and a Microcontroller and embedded microcontroller
2. Familiarize the basic architecture of the 8051 microcontrollers.
3. Explain the architectural features and instructions of 32-bit ARM microcontroller
4. Characteristics of an embedded system.

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Overview of 8051 Microcontroller & Embedded Systems:** Microprocessor Vs Microcontroller, RISC Vs CISC, Harvard Vs Von-Neumann, Embedded Systems, Embedded Microcontrollers, 8051 Architecture, Registers, Pin diagram, I/O ports functions, Internal Memory organization. **(Text1: Sections 1.1 to 1.3 & 3.1 to 3.3)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |
| **Self Study**: Interfacing of External Memory to 8051. |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **8051 Instruction Set:** Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, and Bit manipulation instructions. Examples of assembly language programs. **(Text 1: Chapters 5-8)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint presentation |
| **Self Study**: Programming exercises on Data Transfer, Arithmetic and logical instructions. |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **ARM Embedded System:** RISC Design Philosophy, ARM design Philosophy, Embedded System hardware and Embedded System software.<br>**ARM Processor Fundamentals:** ARM Architecture, Registers, Current Program Status Registers, Pipeline, Exceptions, Interrupts and the Vector table, Core Extensions, Architecture Revisions, ARM processor families **(Text2: Chapter 1 and Chapter 2)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |
| **Self Study**: Understand the concept of pipelining, hazards, and techniques for optimizing pipeline performance. |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **ARM Instructions:** Introduction, Data Processing Instructions, Branch Instructions, Load–Store Instructions, Software Instructions, Program Status Register Instructions, Conditional Execution.<br>**Thumb Instructions:** Thumb register usage, ARM – Thumb Interworking, Other branch Instructions, Data Processing instructions, Single and Multiple Register Load Store Instructions, Stack Instructions, and Software Interrupt Instructions. **(Text2: Chapter 3 and Chapter 4)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |
| **Self Study**: Understand the memory hierarchy in ARM processors, including cache memory, main memory, and memory-mapped I/O. |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only) **(Text 3: Chapter – 1 & Sections 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, 2.4.1 and 2.4.2)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |
| **Self Study**: Explore wireless technologies like Wi-Fi, Bluetooth, Zigbee, and LoR a for communication in embedded systems. Understand their advantages, limitations, and use cases. |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Analyze the architecture of the 8051 microcontrollers, including registers and pin diagrams.
2. Develop proficiency in coding assembly language programs for simple tasks.
3. Explore ARM processor fundamentals, including architecture, registers, and pipelines.
4. Distinguish between ARM and Thumb instructions in terms of usage and interworking.
5. Explain the roles of sensors, actuators, and communication interfaces (I2C, SPI, etc) and Gain insights into the importance of communication protocols like Bluetooth, Wi-Fi, and Zigbee in embedded systems.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The 8051 Microcontroller and Embedded Systems – using assembly and C | Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D McKinlay; | Pearson | 2006 |
| 2 | ARM System Developer's guide | Andrew N Sloss | Elsevier Publications | 2016 |
| 3 | Introduction to Embedded Systems | Shibu K V | Tata McGraw Hill Education Private Ltd, | 2nd Edition. |
| **Reference Books** | | | | |
| 1 | The 8051 Microcontroller | Kenneth J Ayala | Thomson/Cengage Learning | 3rd Edition |
| 2 | The 8051 Microcontroller- Based Embedded Systems | Manish K Patel | McGraw Hill | 2014 |
| 3 | Embedded Systems | Rajkamal | McGraw hill Publications | 2010 |

**e-Resources:**1. https://en.wikipedia.org/wiki/Intel_8051

2. http://centaur.sch.bme.hu/~holcsik_t/sem/The%20Definitive%20Guide%20to%20the%20ARM%20 Cortex-M3.pdf

## Semester: V
## Course Name: C++ and Data Structures

| | | | |
|---|---|---|---|
| Course Code | **21EC541** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basic Knowledge of Programming Language
- Knowledge of Procedural Oriented Language like 'C'

**Course objectives:**
Upon completion of the course, students will be well-versed in C++ programming, object-oriented concepts, and the implementation of various data structures. They will possess problem-solving skills and be capable of designing efficient algorithms to address a wide range of computational challenges, making them competent software developers and programmers. This course is targeting the following key aspects:

1. **Master C++ Programming Basics:**
   - Understand the syntax and semantics of C++ programming language.
   - Learn about variables, data types, operators, and control structures in C++.
   - Develop proficiency in writing C++ programs to solve basic computational problems.

2. **Explore Objects and Classes:**
   - Grasp the principles of object-oriented programming (OOP).
   - Create and use classes and objects to model real-world entities.
   - Implement encapsulation, abstraction, inheritance, and polymorphism.

3. **Understand Data Structures:**
   - Introduce fundamental data structures like arrays and linked lists.
   - Study the implementation and operations of stacks and queues.
   - Analyze the efficiency and suitability of different data structures for specific tasks.

4. **Delve into Trees:**
   - Learn about binary trees and binary search trees (BSTs).
   - Implement tree traversal algorithms and solve tree-based problems.

5. **Problem-Solving and Algorithm Development:**
   - Develop problem-solving skills through coding exercises and challenges
   - Design and analyze algorithms using C++ and data structures.
   - Apply learned techniques to efficiently solve programming problems.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **C++ Programming Basics:** Need for object oriented programming, procedural languages, characteristics of OOP, preprocessor directives, data types, manipulators Type Conversion. **(Text 1: 1.1-1.3, 2.3-2.5)**<br>**Structures:** Structures, enumerated data types. **(Text 1: 4.1-4.2)**<br>**Functions:** Passing arguments, returning values, reference arguments, overloaded functions, inline functions, variable and storage classes. **(Text 1: 5.1-5.5)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Hands-on Coding through a suitable compiler. |
| **Self Learning Topics**: data types, functions |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Objects and Classes:** Objects as data types, constructors, destructors, overloaded constructors. **(Text 1: 6.1-6.3)**<br>**Arrays:** arrays as class member data types, passing arrays, arrays as objects, strings, arrays of strings. **(Text 1: 7.1-7.4)**<br>**Operator Overloading:** Over loading of unary operators, binary operators, data conversion. **(Text 1: 8.1-8.3)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Hands-on Coding through a suitable compiler. |
| **Self Learning Topics**: creating different types of classes, Arrays |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Inheritance:** Inheritance, derived class and base class, overriding member functions, scope resolution, levels of inheritance, multiple inheritances. (Text 1: 9.1-9.2, 9.4-9.5)<br>**Pointers:** Pointers, Pointers to objects, virtual functions, friend functions, Static functions, files and streams, input/output operations. (Text 1: 10.1-10.3) |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Hands-on Coding through a suitable compiler |
| **Self Learning Topics**: implement different types of inheritance |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Data Structures:** Data representation, LINEAR LISTS: Introduction to Linear and Non-Linear data structures, Linear list data structures, Singly Linked lists and chains. **(Text 2: 3.1-3.2)**<br>Arrays and Matrices: Arrays, Matrices, Special matrices, Sparse matrices. **(Text 2: 4.1-4.4)**<br>**Stacks:** The abstract data types, Array Representation, Linked Representation, Applications. **(Text 2: 5.1-5.5)**<br>**Queues:** The abstract data types, Array Representation, Linked Representation. **(Text 2: 6.1-6.3)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Visual Aids, Hands-on Coding through a suitable compiler. |
| **Self Learning Topics**: Implementation of different data structures |

**Module – 5** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Trees:** Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. Binary search trees operations and implementation. Heaps, Applications. **(Text 2: 8.1-8.7)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Visual Aids, Hands-on Coding through a suitable compiler. |
| **Self Learning Topics**: Implementation of algorithms of Binary Search trees |

**Course Outcomes:**

1. Analyze the concepts of object oriented programming and demonstrate various data types, operators and control statements in a C++ program to solve problem.
2. Illustrate functions, class and objects, Integrate new function techniques in class to write C++ programs.
3. Demonstrate inheritance, virtual functions and polymorphism to implement OOPs technique in a C++ program.
4. Identify the different types of data structures and their representation.
5. Outline the importance of Binary Search Trees with their operation and its implementation.

**Assessment Details**

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
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- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks:** | | | | |
| 1 | Object oriented programming in C++ | Robert Lafore | Galgotia Publications | 3rd edition 2003 |
| 2 | Date Structures, Algorithms and Applications in C++ | Sartaj Sahni | Tata McGraw Hill | 2nd edition 2000 |
| **Reference Books:** | | | | |
| 1 | Object Oriented Programming with C++ | E Balaguruswamy | Tata McGraw Hill | 3rd Edition 2006 |
| 2 | C++ Primer | Lippman& J. Lajoie | Addison Wesley | 3rd Edition 2000 |
| 3 | The Complete Reference C++, Herbert Schildt | Herbert Schildt | Tata McGraw Hill | 4th Edition 2003 |

**E-Resources:**

1. https://www.tutorialspoint.com/cplusplus/index.htm

**MOOCs:**

1. https://onlinecourses.nptel.ac.in/noc19_cs38/preview - NPTEL Course on Programming in C++ By Prof. Partha Pratim Das, IIT Kharagpur.

**List of Practical Experiments for Hands-on Practice:**

| SN | Experiments |
|---|---|
| 1 | Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & MIN |
| 2 | Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept. |
| 3 | Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students. |
| 4 | Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively.<br>Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error |
| 5 | Demonstrate simple inheritance concept by creating a base class FATHER with data members:<br>First Name, Surname, DOB & bank Balance and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name &<br>DOB.<br>Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details. |

| | |
|---|---|
| 6 | Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function. |
| 7 | Write a C++ program to accept the student detail such as name and three different marks by get_data() method & display the name & average of marks using display() method. Define a friend function for calculating the average marks using the method mark_avg(). |
| 8 | Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & triangle respectively. |
| 9 | Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary& to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT). |
| 10 | Write a C++ program with different class related through multiple inheritance& demonstrate the use of different access specified by means of members variables & members functions. |
| 11 | Write a C++ program to create three objects for a class named count object with data members such as roll_no& Name. Create a members function set_data ( ) for setting the data values & display ( ) member function to display which object has invoked it using „this‟ pointer. |
| 12 | Write a C++ program to implement exception handling with minimum 5 exceptions classes including two built in exceptions. |

## Semester: VI
## Course Name: Computer Organization and Architecture

| | | | |
|---|---|---|---|
| Course Code | 21EC542 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:** Fundamentals of data representation and Boolean algebra

**Course objectives:**
1. Explain the basic organization of a computer system.
2. Understand different types of semiconductor RAM and Read-Only Memories (ROMs).
3. Understand fundamental concepts of the basic processing unit.
4. Study simple microcontrollers and their architecture.

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **(Text Book 1:1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), 2.2 to 2.10)**<br>**Input / Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB. **(Text Book 1: Sections 4.1, 4.2, 4.4, 4.5, 4.6, 4.7)** |
| **Teaching-Learning Process:** Chalk and Talk, YouTube videos |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **(Text book 1: Sections– 5.1 to 5.4, 5.5 (5.5.1, 5.5.2), 5.6)**<br>**Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Basic concepts of pipelining, **(Text book 1: 8, 8.1)** |
| **Teaching-Learning Process:** Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Operating System Overview, Process description & Control:** Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, what is a Process? Process States, Process Description, Process Control, Execution of the Operating System, Security Issues. **(Text Book Chapter 10)** |
| **Teaching-Learning Process:** Chalk and Talk, YouTube videos |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Arithmetic:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **(Textbook 1: 2, 2.1,6, 6.1 - 6.7)** |
| **Teaching-Learning Process:** Chalk and Talk, YouTube videos |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Embedded Systems and Large Computer Systems: Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller. The structure of General-Purpose Multiprocessors. (Textbook 1: Sections 7: 7.1 to 7.5, 9:9.1 to 9.3, 12 - 12.3) |
| **Teaching-Learning Process:** Chalk and Talk, YouTube videos |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Understand the basic operational concepts of computers.
2. Explore the basic processing unit, execution of instructions, and multiple bus organization.
3. Explore the evolution and major developments leading to modern operating systems.
4. Explore integer division and floating-point numbers and operations.
5. Understand the role of processor chips in embedded applications.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer Organization | Carl Hamacher | 5th Edition, Tata McGraw Hill | 2022 |
| **Reference Books** | | | | |
| 1 | Operating Systems: Internals and Design Principles | William Stallings | 6th Edition, Prentice Hall | 2013 |

**e-Resources:**

1. https://www.udemy.com/course/basic-structure-of-computers-rakshithkalmadi/
2. https://eng.libretexts.org/Courses/Delta_College/Introduction_to_Operating_Systems/08%3A_Processes/8.05%3A_Process_Description

**Semester: V**

**Course Name: Operating Systems**

| | | | |
|---|---|---|---|
| Course Code | **21EC543** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:** Logic Design, C Programming basics.

**Course objectives:**
1. To describe the types of operating system and its principles.
2. To discuss process scheduling and its types in operating systems.
3. To impart the concepts various Memory Management Techniques.
4. To comprehend working of the typical File Systems.
5. To familiarize the concepts of Dead locks and Message Passing.

**Module – 1** **07 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Introduction to Operating Systems:** OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems. **(Topics from Sections1.2, 1.3, 2.2 to 2.8 of Text 1).** |
| **Teaching-Learning Process:** Chalk and talk, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Classification and Use Cases of Different types of Operating Systems other than the ones' mentioned above. |

**Module – 2** **09 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Process Management:** OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Types of Scheduling: Non preemptive scheduling- FCFS and SRN, Preemptive Scheduling-Round Robin and LCN, Case Study: Scheduling in Linux. **(Topics from Sections 3.3, 3.3.1 to3.3.4, 3.4, 3.4.1, 3.4.2, Selected scheduling topics from 4.2 and 4.3, 4.7 of Text 1).** |
| **Teaching-Learning Process:** Chalk and talk, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Thread Management, Lightweight Processes (LWPs) |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux. **(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7, 6.8 of Text 1).** |
| **Teaching-Learning Process:** Chalk and talk, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Memory Protection, Memory Mapping and Shared Memory |

**Module – 4** **08 Hours (RBT Levels:L1, L2, L3)**

| |
|---|
| **File Systems:** File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access. **(Topics from Sections 7.1 to 7.8 of Text 1).** |
| **Teaching-Learning Process:** Chalk and talk, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Distributed File Systems, Encryption and File System Security |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Process Message Passing and Process Deadlocks:** Overview of Message Passing, implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention **(Topics from Sections 10.1to 10.3, 11.1to 11.5 of Text 1).** |
| **Teaching-Learning Process:** Chalk and talk, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Publish-Subscribe Model, Resource Hierarchy and Deadlock Prevention |

**List of demonstration experiments.**

1. Implementation of FCFS (First Come First Serve), Shortest Job First, Round Robin CPU Scheduling Algorithms
2. Implementation of simple programs using process creation and synchronization mechanisms
3. Implementation of FIFO Replacement Algorithm.
4. Implementation of LRU Page Replacement Algorithm by Stack method.
5. Implementation of Optimal Page Replacement Algorithm.
6. Create and manipulate files and directories, implementing file operations
7. Simulate and resolve deadlocks using resource allocation algorithms

**Course Outcomes:**

At the end of the Course, the Students will be able to

1. Compare and contrast the concepts, features, characteristics, and functionality of different operating systems.
2. Outline the concepts of process management and Implement CPU Scheduling algorithms.
3. Implement the principles of Memory Management techniques.
4. Illustrate the working mechanism of File Systems and simple file operations.
5. Demonstrate the concepts of process deadlocks and message passing.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating Systems-A Concept based Approach | D.M. Dhamdhere | TMH | 2nd edition. |
| **Reference Books** | | | | |
| 1 | Operating System Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley India Private Limited | 5th edition, 2001 |
| 2 | Operating System-Internals and Design System | William Stalling | Pearson Education | 4th edition, 2006. |
| 3 | Operating Systems - Design and Implementation | Tanenbaum | TMH | 2001 |

**e-Resources:**

https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.cse.iitb.ac.in%2F~dmd%2Fcs347%2FIntro.ppt&wdOrigin=BROWSELINK.com)
2. https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/
3. https://ocw.mit.edu/courses/6-033-computer-system-engineering-spring-2018/pages/

**Websites and Online Resources:**

- https://www.coursera.org/specializations/codio-introduction-operating-systems
- https://www.shiksha.com/online-courses/introduction-to-operating-systems-specialization- course-courl4836
- https://www.udacity.com/course/introduction-to-operating-systems--ud923
- https://www.coursera.org/specializations/codio-introduction-operating-systems?irclickid=SfOz%3AMzGSxyPUgGUafXlUyeCUkF16uWNq2c2Sc0&irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=259799&utm_content=b2c

## Semester: V
## Course Name: Sensors and actuators for Engineering Applications

| | | | |
|---|---|---|---|
| Course Code | 21EC544 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:** Engineering Physics

**Course objectives:**

- Understand the core principles and practical applications of sensors, actuators, and the interfaces that bridge them in modern engineering and technology.
- They will also gain proficiency in selecting and applying different types of sensors and actuators for specific applications.
- Students will cultivate problem-solving skills, tackle real-world engineering challenges across industries like robotics and IoT and more.
- Stay agile in adapting to emerging trends in smart sensor and actuator technologies to meet evolving industry demands.

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Introduction to Sensors and Actuators:** Definitions of Sensors and Actuators, Classification of Sensors and Actuators, General Requirements for Interfacing, Units **(Text 1: 1.1 to 1.6)** Performance Characteristics of Sensors and Actuators: Introduction Input and Output Characteristics **(Text 1: 2.1 & 2.2)** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** A Short Historical Note |

**Module – 2** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Temperature Sensors and Thermal Actuators:** Introduction, Units of Temperature, Thermoresistive Sensors: Thermistors, Resistance Temperature Sensors, and Silicon Resistive Sensors, Resistance Temperature Detectors (RTD), Silicon Resistive Sensors, Thermistors, Thermoelectric Sensors, Semiconductor Thermocouples, p-n Junction Temperature Sensors. **(Text 1: 3.1 to 3.4).**<br><br>**Optical Sensors and Actuators:** Introduction, Optical Units, Quantum-Based Optical Sensors, Photoelectric Sensor, Coupled Charge (CCD) Sensors and Detectors, Thermal-Based Optical Sensors, Passive IR Sensors, Active Far Infrared (AFIR) Sensors, Optical Actuator. **(Text 1: 4.1, 4.2, 4.5 to 4.10).** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Other Temperature Sensors: Optical and Acoustical Sensors |

**Module – 3** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Electric and Magnetic Sensors and Actuators:** Introduction, Units, The Electric Field: Capacitive Sensors and Actuators, Magnetic Fields: Sensors and Actuators, Magnetic Actuators, Voltage and Current Sensors **(Text 1: 5.1 to 5.4 and 5.9 to 5.10).** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Magnetometers |

**Module – 4** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| Mechanical **Sensors and Actuators:** Introduction, Units and Definitions, Force Sensors, Pressure Sensors. **Text 1: 6.1,6.2 6.3 & 6.5)**<br>**Acoustic Sensors and Actuators:** Introduction, Units and Definitions, Microphones, The Piezoelectric Effect, Acoustic Actuators, Ultrasonic Sensors, and Actuators: Transducers, Piezoelectric Actuators **(Text 1: 7.1,7.2, 7.4 to 7.8)** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Accelerometers |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Smart Sensors and Actuators:** Wireless Sensors and Actuators and Issues Associated with Their Use, Sensor Networks **(Text 1: 10.4,10.4.1& 10.5)**<br>**Interfacing:** General Requirements for Interfacing Sensors and Actuators, Errors **(Text 1: 12.3 & 12.4)** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Interfacing to Microprocessors |

**Course Outcomes:**

At the end of the course, the students will be able to

- Analyze the fundamental principles behind various types of sensors and actuators.
- Evaluate and select appropriate sensors and actuators for specific applications.
- Analyze real-world scenarios where sensors and actuators are used in automation, IoT, robotics, and more.
- Troubleshoot and optimize sensor and actuator systems for efficiency and reliability.
- Adapt to emerging trends in smart sensor and actuator technologies and apply their knowledge to evolving industry needs.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Sensors, Actuators, and their Interfaces-A Multidisciplinary Introduction | Nathan Ida | Sci Tech | 1st Edition, |
| **Reference Books** | | | | |
| 1 | Handbook of Modern Sensors-Physics Design and Application | Phillip A Laplante | Springer | 5th Edition 2015 |

**e-Resources:** Websites like Google Books and Project Gutenberg offer a wide selection of e-books on sensors and actuators. Search for titles like "Introduction to Sensors" or "Actuator Technology.

## Semester: V
## Course Name: Introduction to Computer Networks

| | | | |
|---|---|---|---|
| Course Code | 21EC551 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

### Course objectives:
This course will enable students to:
- Understand the layering architecture of OSI reference model and TCP/ IP protocol suite.
- Understand the protocols associated with each layer.
- Learn the different networking architectures and their representations.
- Learn the functions and services associated with each layer.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Introduction:** Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. **(1.1,1.2, 1.3(1.3.1to 1.3.4 of Text)** **Network Models:** Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. **(2.1, 2.2, 2.3 of Text)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs. |
| **Self Study Topics**: Data representation, types of networks |

**Module – 2** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Data-link Layer:** Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. **(9.1, 9.2(9.2.1, 9.2.2), 11.1, 11.2 of Text)** **Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/ CA. **(12.1 of Text)** Wired and Wireless LANs: Ethernet Protocol, Standard Ethernet. Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control. **(13.1, 13.2(13.2.1 to 13.2.5, 15.1 of Text)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs. |
| **Self Study Topics**: Data link layer functions, wired and wireless LAN Basics |

**Module- 3** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Network Layer:** Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. **(18.1, 18.2, 18.4, 18.5.1, 18.5.2 of Text)** **Network Layer Protocols:** Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. **(19.1 of Text).** **Unicast Routing:** Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing. **(20.1, 20.2 of Text )** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs. |
| **Self Study Topics**: network layer functions |

**Module – 4** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Transport Layer:** Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go- Back-N Protocol, Selective repeat protocol. **(23.1, 23.2.1, 23.2.2, 23.2.3, 23.2.4 of Text)** **Transport-Layer Protocols in the Internet:** User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. **(24.2, 24.3.1, 24.3.2, 24.3.3, 24.3.4, 24.3.5, 24.3.6, 24.3.7, 24.3.8, 24.3.9 of Text)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Visual Aids. |
| **Self Study Topics** :Transport layer basics |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Application Layer:** Introduction: providing services, Application- layer paradigms, Standard Client -Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Wed Based Mail, Telnet: Local versus remote logging. Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS, security of DNS. **(25.1, 26.1, 26.2, 26.3, 26.4, 26.6 of Text)** |
| **Teaching-Learning Process:** Chalk and talk method, PPTs, Visual Aids |
| **Self Study Topics**: Application layer basics |

**Course Outcomes:**

1. Explain the concepts of networking.
2. Describe the various networking architectures.
3. Identify the protocols and services of different layers.
4. Distinguish the basic network configurations and standards associated with each network.
5. Analyze a simple network and measure its parameters.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks:** | | | | |
| 1 | Data Communications and Networking | Behrouz A Forouzan | McGraw Hill, | 5th Edition,2013 |
| **Reference Books:** | | | | |
| 1 | Computer Networks | James J Kurose, Keith W Ross | Pearson education | 6th Edition 2017 |
| 2 | Introduction to Data Communication and Networking | Wayne Tomasi | Pearson education | 1st edition 2007 |

**E-Resources:**

https://www.udemy.com/topic/computer-network/

https://onlinecourses.nptel.ac.in/noc22_cs19/preview - NPTEL Course on networking by Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur

## Semester: V
## Course Name: Information Theory and Coding

| | | | |
|---|---|---|---|
| Course Code | 21EC552 | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

1. Justify the significance of information theory and error control coding in the practical communication system.
2. Analyse statistical modelling of different information sources for a given requirements.
3. Apply fundamental coding theorems to design optimum source encoder using various source coding algorithms for a given specifications.
4. Design optimum channel encoder and decoder using different error control coding schemes.
5. Calculate various design parameters of information theory and coding for a given specifications.
6. Interpret the difference between source coding and channel coding
7. Compare various communication channels in terms of its channel capacity and entropy functions.
8. Apply the fundamental coding techniques to solve engineering related problems.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Information Theory:** Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Mark off Sources **(Section 4.1, 4.2 of Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Source Coding:** Encoding of the Source Output, Shannon's Encoding Algorithm **(Sections 4.3, 4.3.1 of Text 1)**, Shannon Fano Encoding Algorithm **(Section 2.15 of Reference Book 4)**<br><br>Source coding theorem, Prefix Codes, Kraft McMillan Inequality property- KMI, Huffinan codes **(Section 2.2 of Text 2)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Information Channels:** Communication Channels, Discrete Communication channels Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies. **(Section 4.4, 4.5, 4.51,4.5.2 of Text 1)**<br>Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, **(Section 2.5, 2.6 of Text 2)**<br>Binary Erasure Channel, Muroga's Theorem **(Section 2.27, 2.28 of Reference Book4)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.<br>**Binary Cyclic Codes:** Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction **(Sections 9.1, 9.2,9.3,9.3.1,9.3.2,9.3.3 of Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram **(Section 8.5-Articles 1,2 and 3, 8.6-Article 1of Text 2)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

## Course Outcomes:

1. **Examine** mathematically the performance parameters of the digital communication system (information system) to solve simple engineering problems related to it.
2. **Analyze** statistical modeling of independent and dependent information sources (Ex: Markov Source) for the given specifications.
3. **Apply** the basic rules and properties of coding for fundamental Source coding to encode the source output by constructing r-ary codes with the help of suitable optimum source coding algorithm (Shannon's encoding algorithm, Shannon-Fano and Huffman encoding algorithm, arithmetic coding, Lempel-Ziv and Run length coding) for the given specifications.
4. **Analyze** the design aspects of communication channels (Continuous and Discrete Channel Modeling) in terms of channel capacity and entropy functions.
5. **Design** Channel encoder and decoder using different error control coding schemes (Block codes and Convolutional Codes) and realize the importance of Error control coding in Communication systems.

## Assessment Details

### Continuous Internal Examination/ Evaluation (CIE):

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

### Semester End examination (SEE):

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks:** | | | | |
| 1 | Digital and Analog Communication Systems | K. Sam Shanmugam | John Wiley India Pvt Ltd | 1996 |
| 2 | Digital Communication | Simon Haykin | John Wiey India Pvt Ltd | 2008 |
| **Reference Books:** | | | | |
| 1 | ITC and Cryptography | Ranjan Bose | TMH | 2007 |
| 2 | Principles of Digital Communication | J. Das, S.K. Mullick, P. K. Chatterjee | Wiley, Technology &Engineering | 1986 |
| 3 | Digital Communications-Fundamentals and Applications | Bernard Sklar | Pearson Education | 2nd Edition 2016 |
| 4 | Information Theory and Coding | Hari Bhat, Ganesh Rao | Cengage | 2017 |
| 5 | Error Correction Coding | Todd K Moon | Wiley | Std. Edition, 2006 |

**E-Resources:** https://nptel.ac.in/courses/117101053
https://onlinecourses.nptel.ac.in/noc22_ee49/preview

## Semester: V
## Course Name: Linear Integrated Circuits and Applications

| | | | |
|---|---|---|---|
| Course Code | 21EC553 | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

By the end of this course, students will be able to:

- Comprehend the theory and practical application of operational amplifiers (op-amps), including their ideal behavior, inverting/non-inverting amplifier configurations, summing/difference amplifiers, integrators, differentiators, and active filters.
- Design and analyze voltage regulator circuits, gaining insight into their importance for stable power supply solutions in electronic systems.
- Construct and analyze waveform generator circuits, oscillators, and phase-locked loops (PLLs) for generating and synchronizing various types of signals in communication and control systems.
- Develop an understanding of analog multiplier circuits, modulators, and voltage-controlled oscillators (VCOs), and their roles in signal processing and communication applications.
- Design voltage-to-current and current-to-voltage converters, instrumental amplifiers, and filters, essential for interfacing with sensors and accurate signal measurement.
- Apply theoretical knowledge to real-world scenarios, fostering problem-solving skills in the design, analysis, and optimization of circuits employing linear integrated components.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Operational Amplifier Fundamentals:** Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. **OP-Amps as DC Amplifiers–** Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet. **(Text1)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Op-Amps as AC Amplifiers:** Capacitor coupled voltage follower, High input impedance – Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance – Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. **OP-Amp Applications:** Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers. **(Text1)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **More Applications:** Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. **(Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Active Filters:** First order and second order active Low-pass and high pass filters, Bandpass Filter, Band stop Filter. **(Text 1)**<br>**Voltage Regulators:** Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. **(Text 2)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Phase locked loop:** Basic Principles, Phase detector/comparator, VCO.<br>**DAC and ADC convertor:** DAC using R-2R, ADC using Successive approximation.<br>**Other IC Application:** 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. **(Text 2)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, PPT Presentations |

**Course Outcomes:**
1. Analyze Op-Amp circuit parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate.
2. Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower.
3. Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers.
4. Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider.
5. Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps.
6. Realize the applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks:** | | | | |
| 1 | Operational Amplifiers and Linear IC‘s | David A. Bell | PHI/Pearson | 2nd Edition, 2004 |
| 2 | Linear Integrated Circuits | D. Roy Choudhury and Shail B | Jain, New Age International | 4thedition, Reprint 2006 |
| **Reference Books:** | | | | |
| 1 | Op-Amps and Linear Integrated Circuits | Ramakant A Gayakwad | Pearson | 4th Edition, 2015 |
| 2 | Linear Integrated Circuits: Analysis, Design & Applications | B Somanathan Nair | Wiley India. | 1st Edition, 2015. |
| 3 | Linear Electronics Circuits and Devices | James Cox | Cengage Learning, Indian Edition | 2008 |

**E-Resources:**

Data Sheet: http://www.ti.com/lit/ds/symlink/tl081.pdf.

## Semester: V
## Course Name: Principles of Analog and Digital Communication

| | | | |
|---|---|---|---|
| Course Code | **21EC554** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course objectives:**

- Understand the concept of signal processing of Analog information, digital data and signal conversion to symbols at the transmitter and receiver.
- Understand the principles of spread spectrum communications.
- Analyze the basic principles of Analog to Digital Transition.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Introduction to Communication System:** Introduction, Elements of a Communication System, Need for Modulation, Electromagnetic Spectrum and Typical Applications, Terminologies in Communication Systems, Basics of Signal Representation and Analysis.<br>**Amplitude Modulation (AM) Systems:** Introduction, Time and Frequency domain representation, AM Generation-Switching Modulator, AM Detection- Envelop detector, significance of RC time constant in envelop detector, virtues, limitations, and modifications of amplitude modulation, Comparison of AM Modulation techniques-Standard AM, DSBSC, SSB Frequency division Multiplexing. **(Text-1: 3. 1, 3. 2, 3. 4, 3. 7, 3. 8 & Text-2: 1. 1-1. 6)** |
| **Teaching-Learning Process:** Chalk & talk method, PowerPoint Presentation, YouTube videos |
| **Self-Study Topics:** Basic tools for Communication-Fourier Transforms, Trigonometric relations, Dirac Delta function. |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Angle Modulation:** Basic Definitions- Description of phase modulation (PM) and Frequency modulation (FM), Properties of Angle modulated waves, Relationship between FM and PM. Frequency Modulation (FM): Narrow band FM, Wideband FM, transmission bandwidth of FM signals using Carson's Rule.<br>**Generation of FM Signals:** Direct and Indirect method.<br>**Demodulation of FM Signals:** Balanced frequency discriminator and Phase locked loop. FM stereo Multiplexing, Super heterodyne Receiver. **(Text-1: 4. 1-4. 6 &Text-2: Chapter 4)** |
| **Teaching-Learning Process:** Chalk & talk method, PowerPoint Presentation, YouTube videos |
| **Self-Study Topics:** EM Spectrum for FM Broadcasting system [Text-3], Survey on various FM stations around the state. |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Analog to Digital Transition:** Introduction, Why Digitize Analog Sources? The Low pass Sampling Process, Practical aspects of sampling and signal recovery, Types of Sampling (Natural, Flat top / Sample and Hold, Impulse), Pulse Amplitude Modulation, Time Division Multiplexing. The Quantization Random Process, Quantization Noise, Types of Quantization, PCM System.<br>**Line Codes (RZ & NRZ):** Unipolar, Polar, Bipolar, Manchester Coding / Signaling. Other baseband signaling-HDB3, BnZs. **(Text-1: 7. 1-7. 7)** |
| **Teaching-Learning Process:** Chalk & talk method, PowerPoint Presentation, YouTube videos |
| **Self-Study Topics:** Bandwidth requirements for TDM, T1 Carrier Systems- A Case Study (Text 3: 6. 3), Importance of Interleaving. |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Digital Modulation Techniques:** Phase shift Keying Techniques using coherent detection: Generation, detection and error probabilities of Binary Phase shift Keying (BPSK), QPSK, Frequency shift keying techniques using Coherent detection: Generation, detection and error probabilities of Binary Frequency shift Keying (BFSK). **Non Coherent Orthogonal Modulation Techniques:** Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error of BFSK and DPSK, (without derivation of probability of error equation) **(Text 3: 7.8, 7.9, 7.11, 7.15, 7.16).** |
| **Teaching-Learning Process:** Chalk & talk method, PowerPoint Presentation, YouTube videos |
| **Self-Study Topic:** Minimum shift keying and Non-coherent BFSK |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Principles of Spread Spectrum:** Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum. **(Text4:10.3.1 to 10.3.6)** |
| **Teaching-Learning Process:** Chalk & talk method, PowerPoint Presentation, YouTube videos |
| **Self-study topic:** Literature survey on Spread spectrum communication. |

**Course Outcomes:**

1. Apply mathematical tools / transformations to analyze the performance of amplitude modulation schemes (Standard AM, DSBSC, SSB & VSB).
2. Analyze FM modulated / demodulated signals from the learning resources and realize the design principles of FM in audio broadcasting.
3. Relate the design principles of analog to digital transformations in context to digital signal processing / multimedia applications.
4. Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications.
5. Interpret the principles of spread spectrum communications

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Communication Systems | Simon Haykins & M Moher | John Willey India Pvt. Ltd. | 5th Edition & 2010 |
| 2 | Electronic Communication Systems | George Kennedy, Bernard Davis & S R M Prasanna | McGraw Hill Education (India) Private Limited | 5th Edition & 2015 |
| 3 | Digital Communications | Simon Haykins | John Wiley | 2021 |
| 4 | Fundamentals of Communication Systems | John G Proakis and Masoud Salehi | Pearson Education | 2001 |
| **Reference Books** | | | | |
| 1 | Modern Digital and Analog Communication Systems | B. P. Lathi and Zhi Ding | Oxford University Press | 4th Edition & 2010 |
| 2 | Principles of Communication Systems | H Taub & D L Schilling | TMH | 3rd Edition & 2011 |
| 3 | An Introduction to Analog and Digital Communication | Simon Haykins | John Willey India Pvt. Ltd. | 2008 |

**E-Recourses:**

https://archive.nptel.ac.in/courses/117/105/117105143/
https://archive.nptel.ac.in/courses/108/102/108102096/

## V Semester

## Name of the Laboratory: Communication Laboratory-II

| | | | |
|---|---|---|---|
| Course Code | 21ECL56 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 03 |

**Pre-requisites:** Signals and Systems, Analog and Digital circuit fundamentals, Probability theory, Random Processes and Fundamentals of communication theory

**Course objectives:**

This laboratory course enables students to

- **Understand Practical Implementation:** Gain practical knowledge and skills in implementing digital communication systems and coding theory techniques using software and hardware platforms.
- **Apply Theoretical Concepts:** Apply the theoretical concepts learned in the Digital Communication and Coding Theory course to real-world scenarios through practical experiments and simulations.
- **Explore Modulation Techniques:** Explore different modulation schemes such as amplitude shift keying (ASK), frequency shift keying (FSK), and phase shift keying (PSK). Understand their characteristics, advantages, and limitations through hands-on experiments.
- **Study Error Control Coding:** Study various error control coding techniques, including block codes, convolutional codes, and turbo codes. Implement encoding and decoding algorithms to understand their error detection and correction capabilities.
- **Analyze Performance Metrics:** Analyze the performance of digital communication systems and coding techniques by measuring parameters such as bit error rate (BER), signal-to-noise ratio (SNR), and coding gain. Understand the trade-offs between different modulation schemes and coding techniques.
- **Teamwork and Collaboration:** Promote teamwork and collaboration by working on lab experiments in groups. Learn to effectively communicate and share results, ideas, and insights with peers.
- **Develop Practical Skills:** Develop practical skills in using software tools and hardware platforms commonly used in the field of digital communication and coding theory. Gain hands-on experience in implementing algorithms and analyzing system performance.
- **Cultivate Research and Analytical Abilities:** Cultivate research and analytical abilities by conducting experiments, collecting data, and analyzing results. Apply critical thinking to interpret findings and draw conclusions about the performance of digital communication systems and coding techniques.

**List of Experiments:**

| Part A:Design of Experiments using Discrete Components or On-board Kits | |
|---|---|
| **SN** | **Experiments** |
| 1 | FSK generation and detection using IC 4051 |
| 2 | PSK generation and detection using IC 4051 |
| 3 | DPSK generation and detection |
| 4 | QPSK generation and detection |
| 5 | Design and test TDM of two band limited Signals |

| | |
|---|---|
| **Part B: Simulation based Experiments using MATLAB/SCILAB/SIMULINK/LABVIEW/Python or any other Suitable software.** | |
| 1 | Simulate the Huffman encoding algorithm for a given set of symbol probabilities with 5 symbols |
| 2 | Write a program to encode binary data using a ((3, 1, 2)/suitably designed) Convolution code and Decode it. |
| 3 | Simulate PCM encoding and decoding processes. |
| 4 | Generate and plot eye diagrams for various digital modulation schemes and Analyze eye diagrams to evaluate the signal quality, distortion, and timing characteristics. |
| 5 | Computation of probability of bit error for coherent binary Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Phase Shift Keying (PSK) for an AWGN channel. Compare them with their performance curves. |
| **Part C: Open Ended Experiments (Only for CIE, not for SEE)** | |
| 1 | Implement algorithms to estimate channel capacity based on channel characteristics and noise levels. |
| 2 | Investigate cognitive radio principles for dynamic spectrum access and efficient spectrum utilization. |
| 3 | Investigate advanced error correction algorithms and compare their performance with traditional coding schemes. |
| 4 | Design and simulate MIMO communication systems with varying antenna configurations and channel conditions. |
| 5 | Analog and Digital (with TDM) Communication link using OFC |
| 6 | Evaluate various losses in optical communication link (Analog) |
| 7 | Any Open ended experiments/Mini Lab Projects |

**Course Outcomes:**

1. **Course Outcome-1:** Implement Digital Modulation Techniques on Hardware and Analyze the Performance.
   By the end of the course, students will be able to:
   - Design and set up hardware-based experiments for digital modulation techniques, including FSK, PSK, DPSK, and QPSK.
   - Measure and analyze key performance metrics such as bit error rate, signal-to-noise ratio, and spectral efficiency for each modulation scheme.
   - Compare the hardware-based results with theoretical expectations and simulations, identifying practical challenges and limitations.

2. **Course Outcome-2:** Investigate Time Division Multiplexing for two or more Band Limited Signals through Hardware Experiment.
   Upon completion of the course, students will be able to:
   - Construct and test hardware setups to implement time division multiplexing for two band-limited signals.
   - Evaluate the impact of signal bandwidth, sampling rates, and synchronization on the performance of the TDM system.
   - Propose improvements and optimizations based on experimental observations.

3. **Course Outcome-3:** Analyze Analog and Digital Link Performance in Optical Fiber Communication.
   By the end of the course, students will be able to:
   - Comprehend the principles of optical fiber communication systems and the advantages of digital modulation in such system.
   - Establish Analog and digital communication link and carryout performance evaluation in-terms of bandwidth, bit rate or baud rate etc.
   - Calculate various losses in optical communication link (Analog)

4. **Course Outcome-4:** Demonstrate Proficiency in Simulation-based Coding Experiments. By the end of the course, students will be able to:
   - Simulate and evaluate coding schemes like Huffman coding and convolutional coding using software tools.
   - Compare and contrast the efficiency and error correction capabilities of different error coding schemes.
   - Analyze the trade-offs between coding rate, complexity, and performance.
   - Utilize simulation software to generate and interpret eye diagrams for digital modulation techniques like FSK, PSK, DPSK, and QPSK.
   - Compute the probability of bit error for coherent binary ASK, FSK, and PSK in an Additive White Gaussian Noise (AWGN) channel.
   - Compare the simulated results with theoretical performance curves, gaining insights into modulation schemes' robustness and performance.
   - Simulate PCM system to develop comprehensive understanding of analog to digital transformation.

5. **Course Outcome-5:** Explore Open-Ended Experiments and Present Innovative Solutions. At the conclusion of the course, students will be able to:
   - Propose and conduct open-ended experiments related to digital communication and coding theory.
   - Demonstrate creativity and critical thinking in solving practical challenges encountered during open-ended experiments.
   - Communicate their findings and solutions effectively through technical reports and presentations.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | **Total Marks (A+B+C+D)** | | **50** |

**Semester End Evaluation (SEE):**

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-15%, Conduction procedure and result in -70%, Viva-voce 15% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Communication Systems | Simon Haykin | John Willey & Sons | 1st Edition & 2014 |
| 2 | Modern Digital and Analog Communication Systems | B P Lathi & Zhi Ding | Oxford University Press | 4th Edition & 2010 |
| 3 | An introduction to analog and digital Communication system | K Sam Shanmugam | John Willey India Pvt. Ltd. | 3rd Edition & 2008 |
| **Reference Books** | | | | |
| 1 | Digital and Analog Communication Systems | Simon Haykins | John Willey India Pvt. Ltd. | 2008 |
| 2 | Digital Communication | Bernad Sklar | Pearson education | 2007 |
| 3 | Digital Communication | T L Singal | McGraw Hill Education | 2015 |
| **e-Resources/Web Links** | | | | |
| 1 | https://nptel.ac.in/courses/117101051 | | | |
| 2 | https://nptel.ac.in/courses/108102120 | | | |

## V Semester

## Name of the Laboratory: Microcontrollers & Embedded System Lab

| | | | |
|---|---|---|---|
| Course Code | 21ECL57 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 03 |

**Course Objectives:**

1. Understand the instruction set of 8051 microcontroller and ARM cortex M3
2. Apply programming concepts to data transfer, arithmetic operations, logical operations, Code conversion and delay generation in assembly language using 8051 microcontroller
3. Interface external devices and I/O with ARM Cortex M3.
4. Develop C language programs and library functions for embedded system Applications

**List of Experiments:**

| SN | List of Experiments |
|---|---|
| | **Part-A Assembly Language Programs using 8051** |
| 1 | Analyze the computational performance in Data transfer and arithmetic operations. |
| 2 | Demonstrate the use of 8051 branching instructions and analyze their computational performance |
| 3 | Perform analysis on typical code conversions. |
| | **Part- B Interfacing Programs using ARM Cortex M3** |
| 1 | Display a "Hello world" message using the internal UART |
| 2 | Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay. |
| 3 | Demonstrate the use of an external interrupt to toggle an LED On/Off. |
| 4 | Interface a Stepper motor and rotate it in the clockwise and anti-clockwise directions. |
| 5 | Interface a DAC and generate Triangular and Square waveforms. |
| 6 | Interface a DC motor for speed control using PWM concept. |
| | **Part- C Open Ended/mini-project** |
| | Any real-world embedded applications as an open-ended problem/mini-projects |

**Course outcomes:**

1. Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051
2. Develop C language programs and library functions for embedded system Applications
3. Interface external devices and I/O with ARM Cortex M3.
4. Analyze the functions of various peripherals, peripheral registers and power-saving modes of ARM Cortex M3
5. Design and Develop Mini projects

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | **Total Marks (A+B+C+D)** | | **50** |

**Semester End Evaluation (SEE):**

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-15%, Conduction procedure and result in -70%, Viva-voce 15% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The 8051 Microcontroller and Embedded Systems – using assembly and C | Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D McKinlay; | Pearson | 2006 |
| 2 | ARM System Developer's guide | Andrew N Sloss | Elsevier Publications | 2016 |
| 3 | Introduction to Embedded Systems | Shibu K V | Tata McGraw Hill Education Private Limited, | 2nd Edition. |
| **Reference Books** | | | | |
| 1 | The 8051 Microcontroller | Kenneth J Ayala | Thomson/Cengage Learning., | 3rd Edition |
| 2 | The 8051 Microcontroller-Based Embedded Systems | Manish K Patel | McGraw Hill | 2014 |
| 3 | Embedded Systems | Rajkamal | McGraw hill Publications | 2010 |

**e-Resources:**
https://en.wikipedia.org/wiki/Intel_8051
http://centaur.sch.bme.hu/~holcsik_t/sem/The%20Definitive%20Guide%20to%20the%20ARM%20
Cortex-M3.pdf

## Semester: V
## Course Name: Advanced Aptitude

| | | | |
|---|---|---|---|
| Course Code | **21ADA580** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Pre-requisites:**
1. Fundamentals of Mathematics
2. Basic knowledge of Reasoning

**Module – 1: Numerical Ability Based** **03 Hours**

Simplifications, Squares and Square Roots, Cubes and Cube roots, BODMAS Rule, LCM, HCF, Fractions and Decimals

**Module – 2: Percentage Based** **03 Hours**

Percentages, Profit and Loss, Discounts, Simple Interest and Compound Interest

**Module – 3: Time Based** **03 Hours**

Time and Work, Pipes and Cisterns, Time and Distance, Trains, Boats and Streams

**Module – 4: Ratio Based** **03 Hours**

Ratio-proportion, Partnership, Averages and Ages

**Module – 5: Logical and Analytical Based** **03 Hours**

Seating Arrangement, Series, Analogy, Odd man out and Blood Relations

**Course Outcomes:**

**At the end of course students will be able to**
1. Analyze and solve questions based on logical thinking and critical reasoning.
2. Analyze and solve quantitative aptitude problems
3. Solve aptitude problems using fast track techniques
4. Solve puzzle based questions
5. Analyze and solve problems on numerical computation and numerical estimation

## V Semester
## Name of the Course: LINUX Fundamentals

| | | | |
|---|---|---|---|
| Course Code | **21AEC581** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **02** |

**Pre-Requisites:** Basic Computer skills.

**Course Objectives:**
1. To familiarize with basic Linux commands, the file system structure, and common shell features.
2. To introduce file permissions and ownership concepts
3. To learn how to create and manage user accounts and groups, set user privileges, and enforce access control on a Linux system.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Practical hands on sessions along with alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation/ICT to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class/Lab.
4. Ask at least three HOT (Higher order Thinking) questions in the class/lab, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students’ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce topics in diverse representations.
7. Show the different ways to solve the same problem with different methods and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps Improve the students' understanding.

| SN | List of Experiments on LINUX OS |
|---|---|
| 1 | **Obtain the following results**<br>i. To print the name of operating system<br>ii. To print the login name<br>iii. To print the host name |
| 2 | i. Find out the users who are currently logged in and find the particular user too.<br>ii. Display the time in 12-Hour and 24 Hour Notations.<br>iii. Display the Current Date and Current Time |
| 3 | **Display the calendar for**<br>i. August 2023<br>ii. Feb 1999<br>iii. 9th month of the year<br>iv. For the current month<br>v. Current Date Day Abbreviation, Month Abbreviation along with year. |
| 4 | i. Display the name of your home directory.<br>ii. Create a directory SAMPLE under your home directory.<br>iii. Create a sub-directory by name TRIAL under SAMPLE.<br>iv. Change to SAMPLE<br>v. Change to your home directory. |

| | |
|---|---|
| 5 | i. Change from home directory to TRIAL by using absolute and relative pathname.<br>ii. Remove directory TRIAL.<br>iii. Create a directory TEST using absolute pathname<br>iv. Using a single command change from current directory to home directory.<br>v. Remove a directory using absolute pathname. |
| 6 | i. Create files myfile and yourfile under Present Working Directory.<br>ii. Display the files myfile and yourfile.<br>iii. How will you create a hidden file?.<br>iv. Remove the files in the TRIAL directory<br>v. Can you remove a directory with files by using a single command.<br>vi. Is there any command available to get back a deleted file? |
| 7 | i. Rename TRIAL as DATA.<br>ii. Copy DATA to another directory by name TRIAL.<br>iii. Create a file called dummy in TRIAL and link it to another file by name star.<br>iv. Link the dummy file in TRIAL to another file by name power in DATA. |
| 8 | i. Identify the available memory in the system.<br>ii. Display the list of devices connected to your system including the physical names and its instance number.<br>iii. Identify the number of hard disks connected to the system. |
| 9 | i. Create a file using Vi editor<br>ii. Edit the existing file<br>iii. Save and quit<br>iv. Delete the text<br>v. Practice copying and pasting text<br>vi. Perform Search and replace |
| 10 | i. Find the command used to print “Hello Welcome to shell Programming”<br>ii. Find the command used to get the value from the user<br>iii. Find the command used to make a variable as global<br>iv. Find the command used to perform numeric operation<br>v. Illustrate the use of command substitution |

**List of Open Ended Experiments**

| | |
|---|---|
| 1 | Customize the shell environment (e.g., Bash) by modifying the configuration files like bashrc, create aliases, set environment variables |
| 2 | Illustrate the use of commands like find, grep, tar, and rsync to create complex directory structures, searching for files |
| 3 | Task to set permissions and access controls for files and directories to ensure security. |
| 4 | Any other real-world scenario based case study |

**Course outcomes:**

1. Demonstrate the ability to navigate the Linux file system efficiently using a variety of commands, including listing directories, changing directories, and understanding absolute and relative paths.
2. Apply file management skills to create, copy, move, and delete files and directories.
3. Apply user and group management commands to create and manage user accounts, assign users to groups, and modify access permissions, ensuring secure system access.
4. Utilize built-in Linux tools to monitor system performance, including CPU and memory usage, disk space, and running processes.

## Assessment Details

### Continuous Internal Evaluation (CIE):

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | **Total Marks (A+B+C+D)** | | **50** |

### Semester End Evaluation (SEE):

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-15%, Conduction procedure and result in -70%, Viva-voce 15% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 02 hours

### Text Books:

Mark G. Sobel, "A practical guide to LINUX, Commands, Editors and shell programming", 2nd edition, 2013.

**Suggested Learning Resources:**

https://linux.die.net/ https://linuxjourney.com/ https://help.ubuntu.com/community/
https://www.linuxfoundation.org/resources/publications

### e-resources:

https://www.youtube.com/watch?v=akU1Ji8Vzdk&list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ
https://www.youtube.com/watch?v=rRGCGZ6OHw8&list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ&ind ex=2
https://www.youtube.com/watch?v=3eG27YUbzyM&list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ&inde x=3
https://www.youtube.com/watch?v=Z0Vkrn9faoM&list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ&index
=4

## Semester V
## Course Name: Environmental Studies

| | | | |
|---|---|---|---|
| Course Code | 21ENV59 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 02 |

**Pre-requisites:** Water supply and treatment engineering.

**Course objectives:**
1. Understand and evaluate the global scale of environmental problems
2. Reflect critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world

**Module – 1** **08 Hours (RBT Levels: L1, L2, L3)**

**Ecosystems (Structure and Function):** Forest, Desert, Wetlands, Riverine, Oceanic and Lake. Biodiversity: Types, Threats and Conservation of biodiversity. Forest Wealth, and Deforestation.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

**Advances in Energy Systems (Merits, Demerits, Global Status and Applications):** Hydrogen, Solar, OTEC, Tidal and Wind.
**Natural Resource Management (Concept and case-studies):** Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

**Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts,):** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

**Global Environmental Concerns (Concept, policies and case-studies):** Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, YouTube videos.

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.IS. & Remote Sensing. Environment Impact Assessment. Environmental Management Systems.

**Teaching-Learning Process:** Chalk & Talk, PPT presentation, NPTEL materials, you tube videos.

**Course Outcomes:**

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale. Estimate runoff and develop unit hydrographs.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between biotic and a biotic component.
4. Apply their ecological knowledge to illustrate and graph a problem.
5. Describe the realities that managers face when dealing with complex issues.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**SEE:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 01 hours)

1. The question paper will have fifty questions. Each question is set for 01 marks.
2. There will be 10 questions from each module. Each of the 10 questions under a module, should have a mix of topics under that module. The students have to answer 50 multiple choice questions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| | **Textbooks** | | | |
| 1 | Environmental Studies | S M Prakash | Pristine Publishing House, Mangalore | 3rd Edition, 2018 |
| 2 | Environmental Studies | Benny Joseph | Tata Mc Graw-Hill, 2nd Edition | 2012 |
| 3 | Environmental Studies – From Crisis to Cure R | Rajagopalan | Oxford Publisher | 2005 |
| | | | | |
| 1 | Principals of Environmental Science and Engineering | Raman Sivakumar | Cengage learning, Singapur | 2nd Edition, 2005 |
| 2 | Environmental Science - working with the Earth | G.Tyler Miller Jr. | Thomson Brooks /Cole | 11th Edition, 2006 |
| 3 | Text Book of Environmental and Ecology | Pratiba Sing, Anoop Singh & Piyush Malaviya | Acme Learning Pvt. Ltd. New Delhi. | 1st Edition |

## Scheme of Teaching and Evaluation for

# B.E –VI Semester

# Electronics & Comm. Engg.

## (2021 Scheme)

## Semester: VI
## Course Name: Management and Entrepreneurship

| | | | |
|---|---|---|---|
| Course Code | 21EC61 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:**
- Logical reasoning.
- Social, political, economic and industrial awareness.

**Course objectives:**
1. Understand the Management structure, functions and social responsibility of business.
2. Acquire the knowledge of planning, organizing for efficient running of organization.
3. Identify the need of staffing, coordinating and controlling.
4. Conceptualize the need for entrepreneurs and how it impacts the economy of our country.
5. Understand the business model by analyzing various feasibilities.

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

**Management**: Nature and Functions of Management- Importance, Definition Management functions, Levels of Management, Roles of Manager, Managerial Skills, Management as art, science and profession, Management and Administration.
**Social Responsibilities of Business:** Meaning, Social responsibilities of business towards different groups, social audit, Business ethics, Corporate Governance. **(Chapter 1 & 3, Text 1)**

**Teaching-Learning Process:** Chalk and Board, Power point Presentation

**Module – 2** **08 Hours (RBT Levels: L1, L2)**

**Planning**: Importance, Types, Steps and Limitations of planning. Decision Making - Meaning, Types and Steps in decision making.
**Organizing:** Meaning, Principles of organizing, Span of Management, Departmentation- Types of departmentation, Committees, Types of Business Organization-Sole proprietorship, partnership, company-public and private sector enterprise. **(Chapter 4 & 7, Text 1)**

**Teaching-Learning Process:** Chalk and Board, Power point Presentation, Case Study

**Module – 3** **08 Hours (RBT Levels: L1, L2)**

**Staffing**: Need and Importance of staffing, Steps in Recruitment.
**Directing**: Meaning and Need for directing, Behavioral approach of Leadership styles, Motivation Theories: Maslow’s Need-Hierarchy and Herzberg’s two Factor Theory. Coordination: Meaning and importance and Techniques of coordination.
**Controlling**: Meaning and steps in controlling, Essentials of a sound control system, Methods of establishing control (in brief). **(Chapter 11, 15 & 18, Text 1)**

**Teaching-Learning Process:** Chalk and Board, Power point Presentation

**Module – 4** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Entrepreneur**: Meaning of Entrepreneur, Characteristics of an Entrepreneur, Types of Entrepreneurs, Entrepreneurship - Meaning, Myths, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Entrepreneurship - its Barriers. Some examples about the life of Entrepreneurs, their journeys, challenges and their success stories. <br> **Idea Generation and Feasibility Analysis-** Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities. **(Chapter 2, 6 & 7, Text 2)** |
| **Teaching-Learning Process:** Chalk and Board, Power point Presentation, Case Study |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Business model-** Meaning, designing, analyzing and improvising, Business Plan - Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails? <br> **Financing and How to start a Business?** Financial opportunity identification; Banking sources; Nonbanking Institutions and Agencies; Essentials of Economics: Prices and Inflation, Exchange rate, Gross Domestic Product (GDP), Components of GDP. <br> **Venture Capital -** Meaning and Role in Entrepreneurship; Government Schemes for funding business; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise. <br> **(Chapter 5,7,8 Text 1 & Chapter 4 of Text 3)** |
| **Teaching-Learning Process:** Chalk and Board, Power point Presentation |

**Course Outcomes:**

1. Understand the principles of management, social responsibilities and ethics in business.
2. Demonstrate the importance of planning and organization structure in management.
3. Realize and identify the staffing and recruitment process.
4. Explore the necessity of Entrepreneurship quality.
5. Analyze the concepts of business model and sources of funding

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Principles of Management | P.C Tripathi, PN Reddy, | McGraw Hill Education | 6th Edition 2017 |
| 2 | Entrepreneurship Development Small Business Enterprises | Poornima M Charantimath | Pearson Education | 2008 |
| 3 | Essentials of Macroeconomics | Peter Jochumzen | | 1st Edition 2010 |
| **Reference Books** | | | | |
| 1 | Essentials of Management: An International, innovation and Leadership perspective | Harold Koontz, Heinz Weihrich | McGraw Hill Education | 10th Edition 2016 |
| 2 | Dynamics of Entrepreneurial Development and Management | Vasanth Desai | HPH | 2007 |

**e-Resources:**

www.bookboon.com https://rbigradeb.com/

## Semester: VI
## Course Name: Microwaves and Antennas

| | | | |
|---|---|---|---|
| Course Code | 21EC62 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:** Electromagnetic theory, fundamental physics, communication theory, Vector calculus, Integral and differential calculus.

**Course objectives:**
This Theory course enables students to

1. **Understand Microwave Principles:** The course aims to familiarize students with the fundamental principles of microwave engineering, including microwave sources, transmission lines, impedance matching scattering parameters etc. Students will develop a solid foundation in microwave theory and its applications.
2. **Analyze Microwave Devices and Circuits:** Students will learn how to analyze and design microwave components such as attenuators, phase shifters, circulators, isolators, waveguide Tees etc.
3. **Explore Antenna Theory and Design:** The course will cover the principles of antenna theory, radiation patterns, antenna types, and antenna arrays. Students will learn how to design and analyze different types of antennas, including microstrip antennas and non-planar antennas, considering factors like impedance matching, bandwidth, and directivity etc.
4. **Develop Design and Analysis Skills:** Through hands-on projects and assignments, students will enhance their skills in designing, simulating, and analyzing microwave circuits, devices, and antennas. They will have opportunities to apply theoretical knowledge to practical scenarios and develop problem-solving skills.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Microwave Sources:** Introduction, Gunn Diode, Reflex Klystron (Basic Principle and operation only, no numerical problems) **(Text 2: 7.1,7.1.1,7.1.2)**<br>**Microwave transmission lines:** Microwave frequencies, Microwave devices, Microwave systems. Transmission line equations and solutions, Reflection Coefficient and Transmission Coefficient. Standing waves and standing wave ratio. Smith chart, Simple problems on smith chart, Single stub matching. **(Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving, Use of Smith chart tool |
| **Self-Study Topics:** Classification of microwave sources, Types of transmission lines |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Microwave Network Theory**: Introduction, S matrix representation of multi-port networks<br>**(Text 1: 6.1, 6.3, 6.3.1, 6.3.2)**<br>**Microwave passive devices**: Attenuators, Phase shifters, waveguide Tees, Magic Tee, Circulator, Isolator. **(Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16, 6.4.17 A, B)** |
| **Teaching-Learning Process:** Chalk and talk method, Power Point Presentation, YouTube videos. |
| **Self-Study Topics:** Coaxial connectors and Adapters |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Antenna Basics**: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam efficiency, Directivity and Gain, Antenna Aperture Effective height, Bandwidth, Antenna impedance, Radio communication Link, Antenna Field Zones **(Text 3: 2.1-2.7, 2.9- 2.11, 2.13).**<br>**Electric Dipole**: Introduction, Short Electric dipole, Fields of a short dipole (No derivation of field components), Radiation resistance of a short dipole. Thin linear antennas (field analysis), radiation resistance of half wave dipole, folded dipole antennas **(Text 3: 6.1-6.5)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Demonstration through Simulation tools (HFSS/MATLAB). |
| **Self Study Topics:** Antenna Polarization, front back ratio and other antenna parameters, loop antenna |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Point sources and arrays**: Introduction, Point Sources, Power patterns, Power theorem, Radiation Intensity, Arrays of 2 isotropic point sources, Pattern multiplication, Linear arrays of n Isotropic sources of equal amplitude and Spacing. **(Text 3: 5.1-5.6, 5.9, 5.13)**<br>**Basic concepts of Smart Antennas:** Introduction, need of smart antenna system, overview of smart antenna system, Types of smart antennas, Switched beam system, Adaptive beam system, Applications of smart antenna technology. **(Web Link:2)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Demonstration through Simulation tools (HFSS/MATLAB). |
| **Self Study Topics:** Phased array, Intelligent antennas |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Microstrip Antennas:** Introduction, Basic Characteristics of Microstrip antennas, feeding methods, Methods of analysis, Design of rectangular and Circular patch antenna. **(Text 4: 14.1- 14.3)**<br>**Other Antenna Types:** Helical antennas, Yagi Uda antenna, Parabolic Reflector, log periodic antenna and horn antennas, Antennas for Various Applications MW Radio, Cell Phones, Cell Towers, Radar, Satellite and Defense Communications. **(Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint Presentation, YouTube videos, Demonstration through Simulation tools (HFSS/MATLAB). |
| **Self Study Topics:** Slot antenna, reconfigurable antennas |

**Course Outcomes:**

At the end of the course the student will be able to:

1. **Apply** microwave theory to analyze microwave sources, transmission lines problems and utilize impedance matching techniques using the Smith chart.
2. **Design** diverse passive microwave devices, showcasing comprehensive understanding of microwave networks using S-matrix representation, their working principles, behavior, and practical application.
3. **Analyze** critical antenna parameters, including radiation patterns, directivity, gain, impedance etc, and their practical implications in the design of optimum antenna systems and radio communication.
4. **Apply** the concepts of advanced antenna systems, encompassing Electric dipoles, point sources, arrays, and smart antenna technologies, demonstrating comprehensive understanding of their principles, characteristics, for the practical implementation of improved wireless communication systems.
5. **Design** and **optimize** microstrip antennas and diverse antenna types for various applications, showcasing a thorough grasp of their characteristics, feeding methods, analysis techniques, and practical implementation in contemporary wireless communication and technology landscapes.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Microwave Engineering | Annapurna Das & Sisir K Das | TMH Publication | 2nd Edition & 2010 |
| 2 | Microwave Devices and Circuits | Samuel Y Liao | Pearson Education | 3rd Edition |
| 3 | Antennas and Wave Propagation | John D Krauss, Ronald J Marhefka & Ahmad S Khan | McGraw Hill Education | 4th Edition & 2013 |
| 4 | Antenna Theory Analysis and Design | Constantine A Balanis | John Wiley & Sons | 2nd Edition & 2004 |
| **Reference Books** | | | | |
| 1 | Foundation of Microwave Engg | Robert. E.Collin | Mc Graw Hill | 2001 |
| 2 | Microwave Engineering | D.M.Pozar | John Wiley & sons, Inc | 2006 |
| 3 | Antennas and Wave Propagation | K D Prasad | Satya Prakashan | 2021 |
| **e-Resources/ Web Links** | | | | |
| 1 | https://onlinecourses.nptel.ac.in/noc20_ee20/ | | | |
| 2 | https://nptel.ac.in/courses/117107035 | | | |
| 3 | https://www.coursera.org/learn/microwave-antenna | | | |
| 4 | http://www.antenna-theory.com | | | |
| 5 | https://www.tutorialspoint.com/antenna_theory/ | | | |

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Lab based demos for the devices can be done in the form of experiments.
- Mini Projects can be given to students involving design of microwave devices and Antennas.

## Semester: VI
## Course Name: Fundamentals of VLSI Design

| | | | |
|---|---|---|---|
| Course Code | 21EC63 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:**
1. A strong foundation in digital logic is essential, as VLSI design deals with the design and implementation of digital circuits at a very low level.
2. Knowledge of semiconductor materials, diodes, transistors (both MOSFETs and BJTs), and basic semiconductor principles is important for understanding the underlying technology.
3. Understanding both analog and digital electronics is crucial since VLSI design can involve mixed-signal designs that integrate both analog and digital components.

**Course objectives:**
1. Impart knowledge of MOS transistor theory and CMOS technologies
2. Impart knowledge on architectural choices and performance trade-offs involved in designing and realizing the circuits in CMOS technology
3. Cultivate the concepts of subsystem design processes
4. Demonstrate the concepts of CMOS testing

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

**Introduction:** A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, of TEXT2).
**Fabrication**: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).
**Self Study:**
1. Learn about the steps involved in creating MOS transistors on silicon wafers.
2. Understand the concepts of photo-lithography, etching, doping, and diffusion in the context of semiconductor fabrication.

**Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

**MOS and BiCMOS Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout.
**Basic Circuit Concepts:** Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads. (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).
**Self Study:** Study how stick diagrams are used to represent the layout of complex circuits with simple geometric shapes.

**Teaching-Learning Process:** Chalk and talk method, PowerPoint presentation

**Module – 3** **08 Hours (RBT Levels:** L1, L2, L3**)**

**Scaling of MOS Circuits:** Scaling Models & Scaling Factors for Device Parameters
**Design Logics:** Pseudo. Domino and Dynamic
**Illustration of the Design Processes:** Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques **(5.1, 5.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).**
**Self Study:** Explore dynamic logic families (e.g., dynamic NOR, dynamic NAND) and understand their principles, advantages, and trade-offs.

**Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Subsystem Design:** Some Architectural Issues, Switch Logic, Gate (restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) **(6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1).**<br>**FPGA Based Systems:** Introduction, Basic concepts, Digital design and FPGAs, FPGA based System design, FPGA architecture, Physical Design for FPGAs **(1.1 to 1.4, 3.2, 4.8 of TEXT3).**<br>**Self Study:** Study advanced features like clock distribution, memory resources, and DSP blocks. |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Memory, Registers and Aspects of System Timing:** System Timing Considerations, Some commonly used Storage/Memory elements **(9.1, 9.2 of TEXT1).**<br>**Testing and Verification:** Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability **(12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).**<br>**Self Study:** Design small digital systems that incorporate memory elements, registers, and timing considerations. Implement verification strategies on these designs. |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
2. Explain the different layers involved in MOS and BiCMOS technologies and understand the significance of stick diagrams in the initial design phase.
3. Interpret Memory elements along with timing considerations
4. Demonstrate knowledge of FPGA-based system design
5. Interpret testing and testability issues in VLSI Design

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Basic VLSI Design | Douglas A Pucknell & Kamran Eshraghian | PHI | 3rd Edition |
| 2 | CMOS VLSI Design- A Circuits and Systems Perspective | Neil H E Weste, David Harris, Ayan Banerjee | Pearson Education. | 3rd Edition |
| 3 | FPGA Based System Design | Wayne Wolf | Pearson Education | |
| **Reference Books** | | | | |
| 1 | Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuits | Vishwani D Agarwal | Springer | 2002 |
| 2 | CMOS Digital Integrated Circuits: Analysis and Design | Sung Mo Kang & Yosuf Leblebici | Tata McGraw-Hill. | Third Edition |

**e-Resources:**

https://nptel.ac.in/courses/117101058
https://nptel.ac.in/courses/117106093
https://youtu.be/9SnR3M3CIm4
https://nptel.ac.in/courses/108/107/108107129/

## Semester: VI
## Course Name: Machine Learning with Python

| | | | |
|---|---|---|---|
| Course Code | 21EC641 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:**
- Basics of Linear algebra.
- Basics of Probability and Statistics.
- Numerical Statistics.

**Course objectives:**
1. **Learn** the overview of Machine perception, Machine Learning examples and applications.
2. **Illustrate** the concept of learning using candidate elimination algorithm.
3. **Appraise** the types of machine learning.
4. **Realize** the use of Bayesian Decision Theory and Parametric method in Machine Learning.
5. **Illustrate** the concept of Decision trees and Neural Networks in Machine Learning.

**Module – 1** **08 Hours (RBT Levels:L1, L2, L3)**

**Introduction:** What is Machine Learning?, Example Applications of Machine Learning. Machine Perception, An Example, Pattern Recognition systems, The Design cycle, Learning and Adaption
**Self Study:** Why Python? Essential Libraries for machine learning. (**Textbook 1: 1.1 and 1.2 Textbook 2: 1.1 to 1.5)**

**Teaching-Learning Process:** Chalk and Talk, Power Point Presentations. Self Learning: Textbook 6: Chapter 1

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

**Concept Learning:** Well posed learning problems, Designing a Learning system. Perspective and Issues in Machine learning. Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm.
**Self Study:** A First Application using python libraries. (**Textbook 2: 1.1 and 1.3,2.1 to 2.7)**

**Teaching-Learning Process:** Chalk and Talk, Power Point Presentations. Self Learning: Textbook 6: Chapter 1

**Module – 3** **08 Hours (RBT Levels: L1,L2,L3)**

**Types of Machine Learning:** Supervised Learning, Unsupervised Learning, Reinforcement Learning.
**Self Study:** Implementation of supervised learning algorithm using Python. (**Textbook 4: 1.5.1 to 1.5.4)**

**Teaching-Learning Process:** Chalk and Talk, Power Point Presentations. Self Learning: Textbook 6: Chapter 2

**Module – 4** **08 Hours (RBT Levels: L1,L2,L3)**

**Bayesian Decision Theory:** Introduction, Classification, Losses and Risks, Discriminant Functions, Association Rules **Parametric Methods:** Introduction, Maximum Likelihood Estimation, Evaluation an Estimator, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity, Model Selection Procedure. (**Textbook 1: 3.1 to 3.5 and 4.1 to 4.8)**

**Teaching-Learning Process:** Chalk and Talk, Power Point Presentations.

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Decision Tree Learning:** Introduction, Decision Tree Representation, Appropriate problems for Decision Tree Learning, The Basic Decision Tree Algorithm.<br>**Artificial Neural Network:** Characteristics of Neural Network,Histprical developments of Neural Network Principles, ANN-Terminology, Models of Neuron, Topology and Basic Learning Law. (**Textbook 2: 3.1 and 3.4 Textbook 5: 1.1 and 1.6)** |
| **Teaching-Learning Process:** Chalk and Talk, Power Point Presentations. |

**Course Outcomes:**

1. **Learn** the overview of Machine perception, Machine Learning examples and applications.
2. **Illustrate** the concept of learning using candidate elimination algorithm..
3. **Appraise** the types of machine learning.
4. **Realize** the use of Bayesian Decision Theory and Parametric method in Machine Learning.
5. **Illustrate** the concept of Decision trees and Neural Networks in Machine Learning.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Machine Learning | Ethem Alpaydin | The MIT Press | Third Edition- 2014 |
| 2 | Pattern Classification | Richard O. Duda | Wiley-Interscience | 2nd Edition 2000 |
| 3 | Machine Learning | Tom Mitchell | McGraw-Hill | First Edition 1997 |
| 4 | Machine Learning | Saikat Dutt | Pearson | First Edition 2018 |
| 5 | Artificial Neural Network | B.Yagnanarayana | Prentice Hall India | First Edition 2004 |
| 6 | Introduction to Machine learning with Python | Andreas C, Miller | O'Reilly | First Edition 2016 |
| **Reference Books** | | | | |
| 1 | Pattern Recognition and Machine Learning | Christopher M. Bishop | Springer | 2006 |

**e-Resources:**

https://www.youtube.com/playlist?list=PLaXDtXvwY-oDvedS3f4HW0b4KxqpJ_imw

## Semester VI

## Course Name: Real Time Operating Systems

| | | | |
|---|---|---|---|
| Course Code | 21EC642 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-requisites:** Computer Organization & Architecture, Embedded Systems, & C Language

**Course objectives:**

1. Understand the fundamentals of Real-time systems and its classifications.
2. Describe the concepts of computer control and hardware components for Real-Time Application.
3. Explain the concepts of operating system and RTS development methodologies.
4. Discuss Free RTOS task scheduling, prioritization, and states.
5. Outline Queues as the underlying primitive used by all Free RTOS communication and synchronization mechanisms.

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Introduction to Real-Time Systems**: Historical background, Elements of a Computer Control System, RTS-Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs. **(Text 1: 1.1 to 1.6)** Computer Hardware Requirements for Real-Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process- Related Interfaces **(Text 1: 3.1 to 3.5)** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Safety-Critical Real-Time Systems, Real-Time System Security |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Task Co-Operation and Communication, Mutual Exclusion. **(Text 1: 6.1 to 6.8 and 6.10, 6.11).** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material |
| **Self-Study Topics:** Producer-Consumer Problem (Data Transfer), Liveness |

**Module – 3** **08 Hours (RBT Levels: L1, L2,L3)**

| |
|---|
| Design of RTS – General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System. RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method. **(Text 1: 7.1 to 7.5 and 8.1, 8.2, 8.4, 8.5).** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Software development life cycles methods |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Task Management in Free RTOS** Introduction, Task Functions, Top Level Task States, Creating Tasks, Task Priorities, Expanding The 'Not Running' State, The Idle Task And The Idle Task Hook, Changing The Priority Of A Task, Deleting A Task, The Scheduling Algorithm – A Summary. **(Text 2: Chapter 1)** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Interrupt Mechanisms and Management |

**Module – 5** **08 Hours (RBT Levels:L1, L2, L3)**

| |
|---|
| **Queue Management in Free RTOS**<br>Introduction, Characteristics Of A Queue, Using A Queue, Working With Large Data. **(Text 2: Chapter 2)** |
| **Teaching-Learning Process:** Black board teaching, Power Point Presentation, Supplementary Material, Hands-on Lab Session |
| **Self-Study Topics:** Queue Synchronization Mechanisms, Queue Performance Analysis |

**List of demonstration experiments.**
1. Implementation of FIFO Replacement Algorithm.
2. Implementation of LRU Page Replacement Algorithm by Stack method.
3. Implementation of Optimal Page Replacement Algorithm.

**Course Outcomes:**
At the end of the course the student will be able to:
1. Understand the fundamentals of Real time systems and its classifications.
2. Illustrate the operating system concepts and techniques required for real time systems.
3. Apply suitable methodologies to design and develop Real-Time Systems.
4. Implement tasks with changing priorities, manage tasks and delete tasks.
5. Implement, and optimize queue structures to facilitate efficient inter-task communication and synchronization in real-time systems.

**Assessment Details**

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Real-Time Computer Control | Stuart Bennet | Pearson Education | Second edition, 2008. |
| 2 | Using The FreeRTOS Real Time Kernel- A Practical Guide | Richard Barry | FreeRTOS (e-Book) | 2009 |
| | **Reference Books** | | | |
| 1 | Real –Time Systems | C.M. Krishna, Kang G. Shin | McGraw –Hill International Editions | 1997 |
| 2 | Real-Time Systems Design and Analysis | Phillip. A. Laplante | PHI | Second edition, 2005 |
| 3 | Embedded Systems | Raj Kamal | Tata McGraw Hill, India, | Third edition, 2005. |

**e-Resources:**
- https://www.freertos.org/ BUILDING THE EXAMPLES
- http://www.openwatcom.org
- http://www.dosbox.com

## Semester: VI
## Course Name: Speech Signal Processing

| | | | |
|---|---|---|---|
| Course Code | **21EC643** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
Basics concepts of signal processing, Transformations

**Course objectives:**
This Theory course enables students to
1. Processing with familiarization with concept of domain analysis with a qualitative insight into applications in communication.
2. **Core Competence:** To equip students with a basic foundation in Speech Signal Processing by delivering the basics speech model with mathematical description of continuous and discrete time signals and systems, analyzing the signals in time domain using convolution sum, classifying signals into different categories based on their properties, analyzing LTI systems in time and transform domains.
3. **Professionalism :**To inculcate students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.
4. **Learning Environment:** To facilitate students to experience task based learning, peer learning and enable students to inculcate culture, Hands on components by using modern tool.

**Module – 1** **08 Hours (RBT Levels :L1, L2 & L3)**

| |
|---|
| **Fundamentals of Human Speech Production:** The Process of Speech Production, Short-Time Fourier Representation of Speech, The Acoustic Theory of Speech Production, Lossless Tube Models of the Vocal Tract, Digital Models for Sampled Speech Signal, (Text 1: 3.1, 3.2, 3.4 ) |
| **Teaching-Learning Process:** Chalk and Talk Method, YouTube videos, Flipped Class Technique, Programming assignments |
| **Self Study Topics**: Anatomy and Physiology of the Vocal Tract. Acoustic Phonetics: Examine the physical properties of speech sounds, such as frequency |

**Module – 2** **08 Hours (RBT Levels :L1, L2 & L3)**

| |
|---|
| **Time-Domain Methods for Speech Processing:** Introduction to Short-Time Analysis of Speech, Short- Time Energy and Short-Time Magnitude, Short-Time Zero-Crossing Rate, The Short-Time Autocorrelation Function, The Modified Short-Time Autocorrelation Function, The Short-Time Average Magnitude Difference Function. **(Text 1: 4.1 to 4.6)** |
| **Teaching-Learning Process:** Chalk and Talk Method, YouTube videos, Flipped Class Technique, Programming assignments on Short Time Analysis algorithm using tools like Matlab/simulink |
| **Self Study Topics**: Time-Domain Speech Synthesis, Speech Quality Assessment |

**Module – 3** **08 Hours (RBT Levels :L1, L2 & L3)**

| |
|---|
| **Frequency Domain Representations:** Discrete-Time Fourier Analysis, Short-Time Fourier Analysis, Spectrographic Displays, Overlap Addition(OLA),Method of Synthesis, Filter Bank Summation(FBS) Method of Synthesis, Time-Decimated Filter Banks, Two-Channel Filter Banks, Implementation of the FBS Method Using the FFT, OLA Revisited, Modifications of the STFT. **(Text 1:4.1 to 4.5)** |
| **Teaching-Learning Process:** Chalk and Talk Method, YouTube videos, Flipped Class Technique, Programming assignments on visualization of speech using spectrogram. |
| **Self Study Topics**: Speech synthesis |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| The Cepstrum and Homomorphic Speech Processing: Homomorphic Systems for Convolution, Homomorphic Analysis of the Speech Model, Computing the Short-Time Cepstrum and Complex Cepstrum of Speech, Homomorphic Filtering of Natural Speech, Cepstrum Analysis of All-Pole Models, Cepstrum Distance Measures. **(Text 2: 5.1 to 5.3)** |
| **Teaching-Learning Process:** Chalk and Talk Method, YouTube videos, Flipped Class Technique |
| **Self Study Topics:** time-domain analysis, frequency-domain analysis (e.g., Fourier transform), and digital signal processing techniques on speech. |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Linear Predictive Analysis of Speech Signals:** Basic Principles of Linear Predictive Analysis, Computation of the Gain for the Model, Frequency Domain Interpretations of Linear Predictive Analysis, Solution of the LPC Equations, The Prediction Error Signal, Some Properties of the LPC Polynomial A(z), Relation of Linear Predictive Analysis to Lossless Tube Models, Alternative Representations of the LP Parameters. **(Text 2: 6.1 to 6.10)** |
| **Teaching-Learning Process:** Chalk and Talk Method, YouTube videos, Flipped Class Technique, Programming assignments |
| **Self Study Topics**: LPC Analysis and Synthesis |

**Course Outcomes:**

1. **To Analyze** the model speech production system and fundamentals of speech.
2. **To Apply** time and frequency domain algorithms on speech to find, enhance and modify speech parameters.
3. **To understand** and choose an appropriate technique for a given application.
4. **To Analyze** speech recognition, synthesis and speaker identification systems.
5. **To design** open ended experiment on application of speech processing

**Assessment Details**

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Processing of Speech Signals | L. Rabiner and R. W. Schafer | PHI Publications | 2nd Edition & 2004 |
| 2 | Theory and Applications of digital speech | L. Rabiner and R. W. Schafer | PHI Publications | 2nd Edition & 2011 |
| **Reference Books** | | | | |
| 1 | Fundamentals of Speech Recognition | L. Rabiner and B. H. Juang | Prentice Hall | 2003 |
| 2 | Speech and language Processing | Daniel jurafsky and james H Martin | Pearson Prentice Hall | 2009 |

**e-Resources:**

1. **Speech and Audio Processing Group at the University of Edinburgh:** Website: http://www.speech.zone/ Description: This website offers a collection of resources related to speech and audio processing, including tutorials, lecture notes, and links to research papers.
2. **Speech and Language Processing** (3rd Edition) by Daniel Jurafsky and James H. Martin: Website: https://web.stanford.edu/~jurafsky/slp3/ Description: The website accompanies the textbook "Speech and Language Processing" and provides supplementary materials, code examples, and resources for natural language processing and speech processing.
3. **CMU Sphinx (CMU Speech Recognition Toolkit):** Website: https://cmusphinx.github.io/ Description: CMU Sphinx is an open-source speech recognition toolkit that provides resources and tools for building speech recognition systems.
4. **Kaldi Speech Recognition Toolkit:** Website: https://kaldi-asr.org/ Description: Kaldi is a free and open-source toolkit for speech recognition, offering documentation, tutorials, and resources for building automatic speech recognition systems.
5. **OpenSLR:** Website: https://openslr.org/ Description: OpenSLR is a repository of open-source speech and language resources, including speech datasets, acoustic models, and other related tools.
6. **Speech and Audio Signal Processing - MATLAB & Simulink:** Website: https://www.mathworks.com/solutions/speech-audio-signal-processing.html Description: MATLAB & Simulink provide various resources for speech and audio signal processing, including tutorials, examples, and toolboxes

## Semester: VI
## Course Name: Research Methodology & IPR

| | | | |
|---|---|---|---|
| Course Code | **21EC644** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
**Proficiency in English:** A strong command of the English language, as research and IPR discussions often involve reading and writing technical documents
**Basic Computer Literacy:** Use of software tools for data analysis, writing, and presentations, students should have basic computer skills, including word processing, spreadsheet usage, and presentation software.
**Basic of Statistics:** on **c**oncepts such as mean, median, mode, standard deviation, and hypothesis testing.

**Course objectives:**
1. Conduct comprehensive literature reviews to understand the state-of-the-art in a specific research area.
2. Develop effective written and oral communication skills for presenting research findings.
3. Create research reports, papers, and presentations suitable for academic and industry audiences
4. Explore the concepts of patents, copyrights and designs

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Research Methodology:** Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **Defining the Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Reviewing the literature:** Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, enabling contextual findings, review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. **Data Collection:** Introduction, experimental and surveys, collection of primary data, collection of secondary data, selection of appropriate method for data collection |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint presentation |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing research **reports.** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Law of Copyright and Designs, Understanding Copyright Law -** Historical Overview – Justification for Copyright Law - The Natural Law Justification - The Economic Rationale of Copyright Clause, Basic Concepts Underlying copyright Law - Idea – Expression Dichotomy Originality / Creativity – Fixation<br>**Intellectual Property:** The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets,<br>Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992 |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Basic Principles of Design Rights -** Justification for Protecting Designs - Historical Perspective<br>- Features of Shape, configuration, Pattern or Ornament - or Composition of lines or color - New or Original - Applied to an Article, Excluded Subject - Matter - Method or Principle of Construction - Features Dictated Solely by Function - Mechanical Device - Trademark, or Property Mark, or Artistic Work - immoral Designs and Designs Contrary to Public order |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Identify and evaluate relevant literature sources in engineering research
2. Apply statistical techniques to analyze research data and draw meaningful conclusions.
3. Assess the patentability of an innovation based on legal criteria
4. Analyze case studies related to IPR challenges and solutions in engineering and innovation.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module. The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Research Methodology: Methods and Techniques | C.R. Kothari, Gaurav Garg | New Age International | 4th Edition, 2018 |
| 2 | Research Methodology a step-by step guide for beginners. (For the topic Reviewing the literature under module 2) | Ranjit Kumar | SAGE Publications Ltd | 3rd Edition, 2011 |
| 3 | Engineering Research Methodology | Dipankar Deb, Rajeeb Dey | Intelligent Systems Reference Library | |

**e-Resources:**

1. Introduction to Research for Essay Writing and Qualitative Research Methods – Coursera
2. https://www.apa.org/ed/precollege/topss/lessons/research-methods-statistics.pdf
3. https://beta.elsevier.com/products/sciencedirect/industry?trial=true
4. https://ieeexplore.ieee.org/
5. https://ipindia.gov.in/
6. WIPO/USPTO/ Espacenet

## Semester: VI
## Course Name: Internet of Things

| | | | |
|---|---|---|---|
| Course Code | 21EC651 | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

1. Understand the basics of IoT, including its key concepts, technologies, and components.
2. Analyze different ways to connect devices to the Internet, considering factors like data amount, distance, power, and security options.
3. Analyze and derive insights from the growing volume of data generated by IoT devices using advanced query technology and machine-learning techniques.
4. Describe the significance of providing higher levels of service to machines in the context of IoT, considering the benefits to both manufacturers and users.
5. Apply the IoT technology components and business value of precision machines and services from the manufacturer's perspective.

**Module – 1** **08 Hours**

**Introduction – Principles and Practices:** Economics, Not Internet of People, Next Generation Enterprise Software, Internet of Things. **IOT Framework**: IoT Framework, Build Machines, Not Machine Builder, Industry, Summary. **Things Principles:** Sensors, Computer Architecture, Software, Security, Packaging, **Things in Practice:** Wind Turbines, Agricultural Machines, Clinical Hematology Analyzers, High Volume Mail Inserters, Locomotives, Construction Equipment, Next.

**Module – 2** **08 Hours**

**Connect Principle:** Networking Fundamentals, Data-link Layer, Range versus Power, Range versus Data Rate, Application Layer, Network Security. **Connect in Practice:** ZigBee, Wi Fi, Lora WAN, Satellite, Cellular Network, Firewalls, Next. **Collect Principles:** SQL RDBMS, NoSQL, Time Series, Heterogeneous Data, Cloud Computing. **Collect in Practice:** Construction, Water, Power, Healthcare, Financial Services, Next.

**Module – 3** **08 Hours**

**Learn Principles:** Database Query, Prediction, Novelty Detection, Clustering, Dynamic Machine Learning, Learning Lifecycle. **Learn in Practice**: Oil and Gas, Transportation, Power, Healthcare, Next. **Do Principle:** Enterprise Applications, Middleware, Precision Machines: Improve quality of service, Precision Machines: Reduce cost of service, Precision Machines: New business models, Precision Service, Machine vs. Nomic Data, Precision Service: Lower consumables cost, Precision Service: Higher quality product or service, Precision Service: Improved health, Precision Service: Improved safety, Summary. **Do in Practice:** Precision Machines, Precision Service Industries, Packaged IoP, Applications, Next-Generation Middleware.

**Module – 4** **08 Hours**

**Introduction – Solutions. Precision Mailing:** Things, Connect, Collect, Learn, Do. **Precision Mining:** Things, Connect, Collect, Learn, Do. **Precision Agriculture:** Things, Connect, Collect, Learn, Do.

**Module – 5** **08 Hours**

**Precision Healthcare:** Things, Connect, Collect, Learn, Do. **Precision Power:** Things, Connect, Collect, Learn, Do. **Precision Water:** Things, Connect, Collect, Learn, Do.
**Precision Race Car:** Things, Connect, Collect, Learn, Do.

**Course Outcomes:**

After Completing the course the students will be able to

1. Demonstrate a foundational understanding of IoT, including its essential concepts, technologies, and components.
2. Evaluate various methods of connecting devices to the Internet, considering factors such as data volume, transmission distance, power requirements, and available security options.
3. Use advanced tools and methods to understand the large amounts of data produced by IoT devices and gain valuable insights from it
4. Outline the importance of delivering elevated service standards to machines within the IoT landscape.
5. Use IoT technology to improve precision machines and services, and understand how this benefits manufacturers and end users.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

1. The question paper will have ten full questions carrying 20 marks each.
2. There will be two full questions (with a maximum of four sub questions) from each module.
3. The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Precision: Principles, Practices and Solutions for The Internet of Things | Timothy Chou | Crowd Story Publishing | 2016 |
| **Reference Books** | | | | |
| 1 | IOT Inc, | Bruce Sinclair | Mc Graw Hill Pub. | 2017 |
| 2 | Getting Started with the Internet of Things | Cuno Pfister | O'Reilly Media, Inc | 2011 |
| 3 | Programming the Internet of Things | Andy King | O'Reilly Media, Inc | 2021 |

**e-Resources: Precision the Movie: http://www.crowdstory.com/precision**

## Semester: VI
## Course Name: Embedded System Design

| | | | |
|---|---|---|---|
| Course Code | 21EC652 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

1. Describe the philosophy of embedded systems and their design process.
2. Classify different types of memory and their functions in embedded systems.
3. Differentiate between embedded systems and general computing systems.
4. Understand the process of designing and developing embedded systems.

**Module – 1** **10 Hours (RBT Levels: L1, L2)**

| |
|---|
| **Introduction to Embedded System:** Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process.<br>**The Hardware Side:** An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Embedded Systems-A Register View. Text1: Sections 1.1 to 1.5 and 1.10 (Text 1) |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 2** **10 Hours (RBT Levels:** L1, L2, L3)

| |
|---|
| **Memories and the Memory Subsystem:** Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map. **Text1: Sections 4.1 to 4.12 (Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint presentation |

**Module – 3** **10 Hours (RBT Levels:** L1, L2, L3)

| |
|---|
| **Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only) **Ch-1 and Sections 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, 2.4.1 and 2.4.2 (Text 3)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 4** **10 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Embedded Systems Design and Development:** System Design and Development, Life- cycle Models, Problem Solving-Five Steps to Design, The Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification. **Sections 9.1 to 9.12 (Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 5** **10 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **Real-Time Kernels and Operating Systems:** Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited. **Chapters 11 & 12 (Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Understand the concept of embedded systems and their significance.
2. Explain the organization of memory chips and the memory interface in detail.
3. Identify the major components of an embedded system, including memory, sensors, actuators and communication interfaces.
4. Describe the steps involved in problem-solving and designing an embedded system.
5. Explain the concept of sharing resources and managing tasks in an embedded system.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Embedded Systems-A Contemporary Design tool | James K Peckol, | John Weily India Pvt Ltd | 2008 |
| **Reference Books** | | | | |
| 1 | Embedded Systems: Architecture and programming | Raj Kamal | TMH | 2008 |

**e-Resources:**

https://onlinecourses.nptel.ac.in/noc23_cs54/preview
https://onlinecourses.nptel.ac.in/noc20_ee98/preview
https://www.udemy.com/course/mastering-microcontroller

## Semester: VI
## Course Name: Digital Image Processing

| | | | |
|---|---|---|---|
| Course Code | 21EC653 | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**
**By the end of this course, students will be able to:**

1. Understand the fundamental concepts of digital image representation, including pixel structure, color models, and spatial resolution.
2. Comprehend various image enhancement techniques, such as histogram equalization, contrast stretching, and spatial filtering, and apply them to improve image quality.
3. Learn image restoration methods to remove noise, blur, and artifacts from degraded images, utilizing techniques like filtering, deconvolution, and inverse filtering.
4. Gain insights into image compression principles and techniques, such as lossless and lossy compression methods, and understand their significance in efficient storage and transmission.
5. Develop hands-on proficiency in implementing image processing algorithms using software tools commonly used in the field.
6. Engage in practical projects that involve applying image processing techniques to address real-world problems and challenges.
7. Understand the ethical considerations related to digital image manipulation and its potential impact on various applications and industries.
8. Cultivate critical thinking and problem-solving skills by tackling complex image processing tasks and exploring innovative solutions.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Digital Image Fundamentals:** What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition. **(Text: Chapter 1and Chapter 2: Sections 2.1to 2.2, 2.6.2)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, MATLAB Simulation, PPT Presentations |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Image Enhancement in the Spatial Domain:** Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. **(Text: Chapter2: Sections 2.3 to 2.62, Chapter3: Sections3.2 to3.6)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, MATLAB Simulation, PPT Presentations |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Frequency Domain:** Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. **(Text: Cbapter4: Sections 4.2, 4.5 to 4.10)** |
| **Teaching-Learning Process:** Chalk and talk method, Problem Solving, MATLAB Simulation, PPT Presentations |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

**Restoration:** Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. **(Text: Chapter 5: Sections 5.2, to 5.9).**

**Teaching-Learning Process:** Chalk and talk method, Problem Solving, MATLAB Simulation, PPT Presentation0073

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing. **Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing. **(Text: Chapter 6: Sections 6.1 to 6.3 Chapter 9: Sedions9.1 to 9.3)**

**Teaching-Learning Process:** Chalk and talk method, Problem Solving, MATLAB Simulation, PPT Presentations

**Course Outcomes:**

1. Explain the fundamentals of digital image processing.
2. Analyze image formation and the role of human visual system plays in perception of gray and color image data.
3. Apply image processing techniques in both the spatial and frequency (Fourier) domains.
4. Design and evaluate image analysis techniques
5. Conduct independent study and analysis of image Enhancement and restoration techniques.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem-based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks:** | | | | |
| 1 | Digital Image Processing | Rafel C Gonzalez and Richard E. Woods | PHI | 3rd Edition, 2010 |
| **Reference Books:** | | | | |
| 1 | Digital Image Processing | S.Jayaraman, S.Esakkirajan, T. Veerakumar | Tata McGraw Hill | 2014 |
| 2 | Fundamentals of Digital Image Processing | A K. Jain | Pearson | 2004 |
| 3 | Image Processing analysis and Machine vision with Mind Tap | Milan Sonka and Roger Boile | Cengage Publications | 2018 |

**E-Resources:** https://archive.nptel.ac.in/courses/117/105/117105135/

## Semester: VI
## Course Name: Fundamentals of CMOS VLSI Technology

| | | | |
|---|---|---|---|
| Course Code | 21EC654 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**
1. Describe the transition to the integrated circuits era and its significance.
2. Understand the fundamental principles of MOS device design equations.
3. Understand the operation and advantages of pass transistor logic.
4. Understand the challenges and limits of scaling MOS circuits.
5. Illustrate the design process through examples like ALU subsystems, adders, and multipliers.

**Module – 1** **08 Hours (RBT Levels:** L1, L2**)**

| |
|---|
| **BASIC MOS TECHNOLOGY:** Integrated circuits era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. **Chapter – 1 (Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **MOS TRANSISTOR THEORY:** Introduction, MOS Device Design Equations, The Complementary CMOS Inverter DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter **Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout. Chapter – 2 (Text 1) |
| **Teaching-Learning Process:** Chalk and talk method, PowerPoint presentation |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **CMOS Logic Structures:** CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL). Chapter – 3 (Text 1) |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **BASIC CIRCUIT CONCEPTS:** Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.<br>**SCALING OF MOS CIRCUITS:** Scaling models and factors. Limits on scaling. Limits due to current density and noise. **Chapter – 4 (Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **CMOS SUBSYSTEM DESIGN PROCESSES:** General considerations. Process illustration. ALU subsystem. Adders. Multipliers.<br>**TESTABILITY:** Performance parameters. Layout issues. I/O pads. Real estate. System delays. Ground rules for design. Test and testability. **Chapter – 6 and Chapter – 8 (Text 1)** |
| **Teaching-Learning Process:** Chalk and talk method, YouTube videos, PowerPoint presentation |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Describe the transition to the integrated circuits era and its significance.
2. Design static load MOS inverters and understand their characteristics.
3. Describe various CMOS logic structures including complementary, BiCMOS, pseudo- nMOS, dynamic, and clocked CMOS logic.
4. Calculate sheet resistance and area capacitances for MOS circuits.
5. Explain the concept of testability in circuit design, including performance parameters and layout considerations.

## Assessment Details

**Continuous Internal Examination/ Evaluation (CIE):**

| Components | | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**Semester End examination (SEE):**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Basic VLSI Design | Douglas A Pucknell & Kamran Eshraghian | PHI, 3rd Edition | 2005 |
| **Reference Books** | | | | |
| 1 | CMOS VLSI Design- A Circuits and Systems Perspective | Neil H E Weste, David Harris, Ayan Banerjee | 3rd Edition, Pearson Education. | 2000 |
| 2 | FPGA Based System Design | Wayne Wolf | Pearson Education | 2005 |

**e-Resources:**

https://onlinecourses.nptel.ac.in/noc21_ee09/preview
https://archive.nptel.ac.in/courses/108/107/108107129/

## VI Semester

## Name of the Laboratory: Microwaves and Antennas Laboratory

| | | | |
|---|---|---|---|
| Course Code | 21ECL66 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 20 | Total Marks | 100 |
| Credits | 01 | Exam Hours | 03 |

**Pre-requisites:** Electromagnetic theory, fundamental physics, communication theory, Vector calculus, Integral and differential calculus.

**Course objectives:**

This laboratory course enables students to

1. **Understand Microwave Concepts:** Gain practical knowledge and skills in working with microwave frequencies, components, and systems. Develop an understanding of microwave propagation, transmission lines, and waveguides.
2. **Design and Characterize Microwave Circuits:** Design and analyze microwave circuits, such as Power dividers, ring resonators, directional coupler, waveguide Tees etc.
3. **Work with Microwave Measurement Equipment:** Gain hands-on experience in using microwave measurement equipment, such as microwave sources, power meters, VSWR meters, microwave test bench etc. Learn to perform measurements and interpret the obtained results.
4. **Antenna Design and Analysis:** Learn the principles of antenna design and analysis. Design and simulate various types of antennas, such as dipole antennas, patch antennas, and horn antennas. Characterize their radiation patterns and impedance properties.
5. **Microwave System Integration:** Gain experience in integrating microwave components and designing microwave systems. Understand the challenges and considerations involved in system integration, including impedance matching, power handling, and noise figure.
6. **Simulation and Analysis:** Utilize simulation tools, such as HFSS or CST Microwave Studio to model and analyze microwave circuits, components, and antennas. Compare simulation results with practical measurements to validate the theoretical concepts.
7. **Project Work:** Undertake individual or group projects involving the design, implementation, and evaluation of microwave circuits or antenna systems. Apply theoretical concepts and practical skills to solve real-world microwave engineering problems.
8. **Documentation and Reporting:** Enhance technical communication skills by documenting experimental setups, measurement procedures, and results. Prepare reports summarizing the design, analysis, and evaluation of microwave circuits and antennas.
9. **Safety and Ethical Considerations:** Understand and adhere to safety guidelines while working with microwave equipment. Develop an understanding of ethical considerations in the field of microwave engineering, such as responsible use of electromagnetic radiation and respecting intellectual property rights.

**List of Experiments:**

| SN | Experiments |
|---|---|
| | **Part A:Design of Experiments using Discrete Components or On-board Kits** |
| 1 | V- I Characteristics of Gunn-diode/Reflex Klystron. |
| 2 | Measurement of frequency, free space wave length, cut-off wavelength and guided wave length in a microwave test bench. |
| 3 | Study of characteristics of Magic Tee. |
| 4 | Determination of power division and isolation characteristics of microstrip power divider. |
| 5 | Coupling and Isolation characteristics of microstrip directional coupler. |
| 6 | Determination of resonance characteristics of microstrip ring resonator and computation of Dielectric constant of the substrate. |
| 7 | Obtain the Radiation pattern of a given Microstrip Patch Antenna or any planar antenna and calculate its directivity. |
| | **Part B: Simulation based Experiments using MATLAB/SCILAB or any other Suitable software.** |
| 1 | Study of impedance matching using MATLAB |
| 2 | Simulate antenna arrays and analyze their performance by specifying array parameters, such as element spacing, number of elements, and array geometry. |
| 3 | Demonstrate the use of smith chart to calculate reflection coefficient and VSWR. |
| 4 | Design Rectangular microstrip patch antenna for a given specifications. |
| | **Part C: Demo/Open Ended Experiments (Only for CIE, not for SEE)** |
| 1 | Design of a Patch Antenna using HFSS Software. |
| 2 | Design of a dipole Antenna using HFSS Software. |
| 3 | Any Open ended experiments/Mini Lab Projects |

**Course Outcomes:**

At the end of the course the student will be able to:

1. **Analyze** the V-I characteristics of Gunn-diode/Reflex klystron, Magic Tee and crucial microwave parameters such as frequency, free space wavelength, cut-off wavelength, and guided wavelength within a microwave test bench, fostering a comprehensive understanding of their operational principles.
2. **Measure** power division and isolation characteristics of planar microstrip power dividers, coupling and isolation attributes of planar microstrip directional couplers and precisely ascertain resonance characteristics of planar microstrip ring resonators for S- band applications.
3. **Interpret** radiation patterns of Planar Microstrip Antennas, exploring antenna properties/parameters in controlled environments using S-band measurement setups and acquire practical insights of antenna testing.
4. Proficiently **utilize** simulation tools for analyzing microwave applications, specifically quantifying transmission lines and antenna system behavior as per given specifications through simulation exercises.
5. **Conduct** Open-Ended Experiments/Mini lab projects related to microwaves and antenna systems and propose innovative solutions.

## Assessment Details

### Continuous Internal Evaluation (CIE):

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | **Total Marks (A+B+C+D)** | | **50** |

### Semester End Evaluation (SEE):

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-**15%**, Conduction procedure and result in **-70**%, Viva-voce **15%** of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours

### Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Microwave Engineering | Annapurna Das & Sisir K Das | TMH Publication | 2nd Edition & 2010 |
| 2 | Microwave Devices and Circuits | Samuel Y Liao | Pearson Education | 3rd Edition |
| 3 | Antennas and Wave Propagation | John D Krauss, Ronald J Marhefka & Ahmad S Khan | McGraw Hill Education | 4th Edition & 2013 |
| 4 | Antenna Theory Analysis and Design | Constantine A Balanis | John Wiley & Sons | 2nd Edition & 2004 |
| | **Reference Books** | | | |
| 1 | Foundation of Microwave Engg | Robert. E.Collin | Mc Graw Hill | 2001 |
| 3 | Antennas and Wave Propagation | K D Prasad | Satya Prakashan | 2021 |

### e-Resources/ Web Links

1. https://onlinecourses.nptel.ac.in/noc20_ee20/
2. https://nptel.ac.in/courses/117107035
3. https://www.coursera.org/learn/microwave-antenna
4. http://www.antenna-theory.com
5. https://www.tutorialspoint.com/antenna_theory/
6. https://www.mathworks.com/help/antenna/

## VI Semester
## Name of the Laboratory: VLSI Lab

| | | | |
|---|---|---|---|
| Course Code | **21ECL67** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Pre-Requisites:**
- Knowledge about Logic Gates.
- Knowledge about Verilog and VHDL programming.
- Knowledge about CMOS characteristics and circuit design.

**Course Objectives:** Students will be able
1. To understand and develop the test bench code for combinational and sequential circuits.
2. To learn the fundamental principles of VLSI circuit design in digital and analog domain.
3. To experience hands on VLSI circuit design with professional design (EDA) platforms.

**List of Experiments:**

| SN | Experiments |
|---|---|
| | **PART A: Digital Design** |
| 1 | **Bit Adder**<br>i. Write Verilog Code<br>ii. Verify the Functionality using Test-bench<br>iii. Synthesize the design by setting proper constraints and obtain the netlist.<br>From the report generated identify Critical path, Maximum delay, Total number of cells, Power requirement and Total area required |
| 2 | **Bit Unsigned Array Multiplier**<br>i. Write Verilog Code<br>ii. Verify the Functionality using Test-bench<br>iii. Synthesize the design by setting proper constraints and obtain the netlist.<br>From the report generated identify Critical path, Maximum delay, Total number of cells, Power requirement and Total area required |
| 3 | **Latch and Flip-Flop**<br>i. Synthesize the design and compare the synthesis report (D, SR, JK) |
| 4 | **Bit ALU Supporting 4-Logical and 4-Arithmetic operations, using case and if statement for ALU Behavioral Modeling**<br>i. Write Verilog Code<br>ii. Verify functionality using Test-bench<br>iii. Synthesize the design targeting suitable library and by setting area and timing constraints<br>iv. Tabulate the Area, Power and Delay for the Synthesized netlist<br>v. Identify Critical path |

| | |
|---|---|
| | **PART B: Analog Design** |
| **SN** | **Experiments** |
| 1 | Capture the schematic of n-MOSFET and set the widths w=2u and length at selected technology. Carry out the following:<br>i. Obtain VGS VS ID simulation. |
| 2 | a) Capture the schematic of CMOS inverter with load capacitance of 0.1pF and set the widths of Inverter with Wn = Wp, Wn = 2Wp, Wn = Wp/2 and length at selected technology. Carry out the following:<br>i. Set the input signal to a pulse with rise time, fall time of 1ns and pulse width of 10ns and the time period of 20ns and plot the input voltage and output voltage of designed inverter?<br>ii. From the simulation result compute tpHL, tpLH and td for all three geometrical settings of width?<br>iii. Tabulate the results of delay and find the best geometry for minimum delay for CMOS inverter?<br><br>b) Draw layout of inverter with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with prelayout simulations. Record the observations |
| 3 | a) Capture the schematic of 2-input CMOS NAND gate having similar delay as that of CMOS inverter computed in experiment above. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors, tabulate the results. Increase the drive strength to 2X and 4X and tabulate the results.<br>b) Draw the layout of NAND with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre layout simulations. Record the observations. |
| 4 | Capture schematic of Common Source Amplifier with PMOS Current Mirror Load and find its transient response and AC response? Measure the Unit Gain Bandwidth (UGB), amplification factor by varying transistor geometries, study the impact of variation in width to UGB. |
| | **Part C: Open Ended Experiments (Only for CIE, not for SEE)** |
| 1 | **UART**<br>i. Write Verilog Code<br>ii. Verify the Functionality using Test-bench<br>iii. Synthesize the design targeting suitable library and by setting area and timing constraints<br>iv. Tabulate the Area, Power and Delay for the Synthesized netlist, Identify Critical path |
| 2 | **For synthesized netlist carry out the following:**<br>i. Floor planning<br>ii. Placement and Routing<br>iii. Record the parameters such as no. of metal layers used for routing, flip method for placement of standard cells<br>iv. Physical Verification and record the DRC and LVS reports<br>v. Generate GDSII |
| 3 | **Capture schematics of two-stage operational amplifier and measure the following:**<br>i. UGB<br>ii. dB Bandwidth<br>iii. Gain Margin and phase margin with and without coupling capacitance<br>iv. Use the op-amp in the inverting and non-inverting configuration and verify its functionality.<br>v. Study the UGB, 3dB bandwidth, gain and power requirement in op-amp by varying the stage wise transistor geometries and record the observations. |

**Course outcomes:**

1. **Design** and simulate combinational and sequential digital circuits using Verilog HDL.
2. **Perform** ASIC design flow for combinational & sequential digital circuits and demonstrate the process of synthesis, synthesis constraints and evaluate the synthesis reports to obtain optimum gate level net list.
3. **Design** schematic and simulation of NMOSFET, CMOS inverter, NAND gate and common source amplifier.
4. **Design** layout and perform physical verification of CMOS inverter, NAND gate and verify for DRC and LVS.
5. **Perform** RTL to GDSII flow and demonstrate the stages in ASIC design.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | **Total Marks (A+B+C+D)** | | **50** |

**Semester End Evaluation (SEE):**

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal
- /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-**15**%, Conduction procedure and result in **-70**%, Viva-voce **15%** of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

**Text Books:**

Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Pearson Education, Second edition, 2003.
Douglas A Pucknell, Kamran Eshraghian "Basic VLSI Design", 3rd Edition, Prentice Hall of India publication, 2005.

**e-resources:**

1. https://www.asic-world.com/digital/index.html
2. https://www.youtube.com/playlist?list=PLqsyARCuPNKERXT-1kcIRyYhYy6T9NWTg

## VI Semester
## Name of the Laboratory: Internet of Things Laboratory

| | | | |
|---|---|---|---|
| Course Code | **21AEC690** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **02** |

**Pre-Requisites:** Programming with hardware controllers, Sensors and actuators.

**Course Objectives:**
1. To Implement Hardware Prototype for any given embedded applications.
2. To Develop basic programming skills for deploying various IoT protocols in hardware
3. To understand functionalities of various single board embedded platforms fundamentals
4. To develop comprehensive approach towards building small low cost embedded IoT system.

**List of Experiments:**

| SN | Experiments |
|---|---|
| 0. | Introduction to IoT, Benefits/challenges, architecture, Overview of Internet fundamentals. |
| 1. | Configuring Wi-Fi module, PIN outs, Wifi connectivity etc. |
| 2. | Interfacing various sensors and actuators with Node MCU ESP 8266. |
| 3. | Cloud communication using MQTT protocol through any MQTT broker and Sensor Interfacing and Logging using Hive MQTT (Publish, Subscribe operations). |
| 4. | Data visualization/ Analysis for IoT-specific use cases and computing on Thingspeak cloud platform. |
| 5. | Introduction to Raspberry Pi, Porting OS and Interfacing basic hardware (Simple Sensors/Actuators) with Raspberry Pi. |
| 6. | Interfacing onboard camera with Raspberry Pi. |
| **Capstone Projects/Open ended Experiments** | |
| Any suitable capstone projects, it may include Node MCU/Raspberry Pi interfacing and use of Cloud platforms, IoT communication Protocols targeting real world problems | |

**Course Outcomes:**
On completion of the course, student will be able to
1. Interface basic digital and Analog Sensors/Actuators using Node MCU
2. Interface basic digital and Analog Sensors/Actuators using Raspberry Pi
3. Analyse various IoT Protocols used in IoT Applications
4. Implement the solution using Node MCU / raspberry pi for a given open ended problem relevant to IoT applications

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments / Mini Lab Projects (D) | 20% | 10 |
| | **Total Marks (A+B+C+D)** | | **50** |

**Semester End Evaluation (SEE):**

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute.
- All laboratory experiments are to be included for practical examination.
- Based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE is mentioned here, writeup-**15%**, Conduction procedure and result in **-70%**, Viva-voce **15%** of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 02 hours

**Suggested Learning Resources:**

1. Nitesh Dhanjani, “Abusing the Internet of Things”, O'REILLY, ISBN: 13:978-93-5313- 217-1
2. Cuno Pfister, “Getting Started with the Internet of Things”, O'REILLY, ISBN: 13:978- 93- 53023-413-6.
3. Massimo Banzi and Michael Shiloh, “Getting Started with Arduino”, MAKER MEDIA, ISBN: 13:978-93- 5110-907-5
4. Don Wilcher, “BASIC Arduino Projects”, MAKER MEDIA, ISBN: 13:978-93-5110- 503-9
5. Cefn Hoile, Clare Bowman, Sjoerd Dirk Meijer, Brian Corteil, Lauren Orsini, “Raspberry Pi and AVR Projects”, MAKER MEDIA, ISBN: 13:978-93-5110-914-3
6. Wolfrom Donot, “A Raspberry Pi Controlled Robot”, MAKER MEDIA, ISBN: 13:978- 93- 5110-913-6
7. Kimmo Karvinen and Tero Karvinen, “Arduino Bots and Gadgets”, O'REILLY, ISBN: 13:978-93-5023-374-0
8. Derek Molley, “Exploring Beaglebone”, Willey, ISBN: 978-1-118-935125
9. Matt Richardson and Shawn Wallace, “Getting with Raspberry Pi”, MAKER MEDIA, ISBN: 978-93-5213-450-2.
10. Dr. Simon Monk, “Raspberry PiCook-Book”, O'REILLY, ISBN: 978-93-5213-389-5.

# Syllabus of III to VIII Semesters B.E.

(With effect from 2018-19)

# Electronics & Communication Engineering


## Visvesvaraya Technological University, Belagavi.

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# Visvesvaraya Technological University, Belagavi.

Regulations Governing the Degree of Bachelor of Engineering/ Technology (B.E./B.Tech.)

Under Outcome Based Education (OBE) & Choice Based Credit System (CBCS)

## Effective from the Academic Year 2018 – 19

**DEFINITIONS OF KEYWORDS**

The following are the definitions/descriptions that have been followed for the different terms used in the Regulations of B.E./B.Tech. Programmes:

1) **Programme:** Is an educational programme in a particular stream/ branch of Engineering/branch of specialization leading to award of the Degree. It involves events/activities, comprising of lectures/ tutorials/ laboratory work/ field work, outreach activities/ project work/ vocational training/ viva voce/ seminars/ internship/ assignments/ presentations/ self-study etc., or a combination of some of these.
2) **Branch:** Means Specialization or discipline of B.E./B.Tech. Degree Programme, like Civil Engineering, Mechanical Engineering, Textile Engineering, etc.
3) **Semester:** Refers to one of the two sessions of an academic year (vide: serial number 4), each session being of sixteen weeks duration (with working days greater than or equal to ninety).The odd and even semesters shall be as per the University academic calendar.
4) **Academic Year:** Refers to the sessions of two consecutive semesters (odd followed by an even) including periods of vacation.
5) **Course:** Refers to usually referred to as 'papers' and is a component of a programme. All Courses need not carry the same weight. The Courses should define learning objectives and learning outcomes. A Course may be designed to comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/project work/ vocational training/ viva voce/ seminars/ term papers/assignments/ presentations/ self-study etc., or a combination of some of these.
6) **Credit:** Refers to a unit by which the Course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of lecture or two hours of laboratory/practical Courses/ tutorials/ fieldwork per week etc.
7) **Audit Courses:** Means the Knowledge/ Skill enhancing Courses without the benefit of a grade or credit for a Course.
8) **Choice Based Credit System (CBCS):** Refers to customizing the Course work, through Core, Elective and soft skill Courses, to provide necessary support for the students to achieve their goals.
9) **Course Registration:** Refers to formal registration for the Courses of a semester (Credits) by every student under the supervision of a Faculty Advisor (also called Mentor, Counsellor etc.,) in each semester for the Institution to maintain proper record.

10) **Course Evaluation:** Means Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE) to constitute the major evaluations prescribed for each Course. CIE and SEE to carry 40 % and 60 % respectively, to enable each Course to be evaluated for 100 marks, irrespective of its Credits.

11) **Continuous Internal Evaluation (CIE):** Refers to evaluation of students' achievement in the learning process. CIE shall be by the Course Instructor and includes tests, homework, problem solving, group discussion, quiz, mini-project and seminar throughout the semester, with a weightage for the different components being fixed by the University.

12) **Semester End Examinations (SEE):** Refers to the examinations conducted by the University covering the entire Course Syllabus. For this purpose, Syllabi to be modularized and SEE questions to be set from each module, with a choice confined to the concerned module only. SEE is also termed as University examination.

13) **First Attempt:** Refers to a student who has completed all formalities and has become eligible to attend the SEE and has attended at least one head of passing, such attempt shall be considered as first attempt.

14) **Credit Based System (CBS):** Refers to quantification of Course work, after a student completes teaching – learning process, followed by passing in both CIE and SEE. Under CBS, the requirement for awarding degree is prescribed in terms of total number of credits to be earned by the students.

15) **Credit Representation:** Refers to the Credit Values for different academic activities considered, as per the Table.1. Credits for seminar, project phases, project viva–voce and internship shall be as specified in the Scheme of Teaching and Examinations.

**Table 1: Credit Values**

| Theory/ Lectures (L) (hours/week/ Semester) | Tutorials (T) (hours/week/ Semester) | Laboratory/Practical (P) (hours/week/Semester) | Credits (L:T:P) | Total Credits |
|---|---|---|---|---|
| 4 | 0 | 0 | 4:0:0 | 4 |
| 3 | 0 | 0 | 3:0:0 | 3 |
| 2 | 2 | 0 | 2:1:0 | 3 |
| 2 | 0 | 2 | 2:0:1 | 3 |
| 2 | 2 | 2 | 2:1:1 | 4 |
| 0 | 0 | 6 | 0:0:3 | 3 |
| **NOTE:** Activities like, practical training, study tour and participation in Guest lectures not to carry Credits. | | | | |

16) **Letter Grade:** It is an index of the performance of students in a said Course. Grades are denoted by letters S, A, B, C, D, E and F.

17) **Grading:** Grade refers to qualitative measure of achievement of a student in each Course, based on the percentage of marks secured in CIE and SEE. Grading is done by Absolute Grading [Refer: 18 OB

6.0]. The rubrics attached to letter grades are as follows:
S – Outstanding, A – Excellent, B – Very Good, C – Good, D – Above Average, E – Average and F – Fail.

18) **Grade Point (GP):** Refers to a numerical weightage allotted to each letter grade on a 10-point scale as under.

| **Letter Grade and corresponding Grade Points on a typical 10 – Point scale** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Letter | S | A | B | C | D | E | F |
| Grade | 10 | 09 | 08 | 07 | 06 | 04 | 00 |
| | | | | | | | |

19) **Passing Standards:** Refers to passing a Course only when getting GP greater than or equal to 04 (as per serial number 18).

20) **Credit Point:** Is the product of grade point (GP) and number of credits for a Course i.e.,
**Credt points (CrP)=GP×Credits for the Course.**

21) **Semester Grade Point Average (SGPA):** Refers to the measure of academic performance of student/s in a semester. [Refer:18 OB 6.2]

22) **Cumulative Grade Point Average (CGPA):** Is a measure of overall cumulative performance of a student over all semesters. [Refer:18OB6.2]

23) **Grade Card:** Refers to the certificate showing the grades earned by a student. A grade card shall be issued to all the registered students after every semester end examination. The grade card will display the Programme details (Course code, title, number of credits, grades secured) along with SGPA of that semester and CGPA earned till that semester.

24) **University:** Visvesvaraya Technological University (VTU), Belagavi.

# Visvesvaraya Technological University, Belagavi.

Regulations Governing the Degree of Bachelor of Engineering/ Technology (B.E./B.Tech.)

Under Outcome Based Education (OBE) & Choice Based Credit System (CBCS)

## Effective from the Academic Year 2018 – 19

| | |
|---|---|
| **18OB1.0** | **Title, Duration and Credits of the Programme of Study.** |
| **18OB1.1** | The Programme of study shall be called the degree of Bachelor of Engineering / Bachelor of Technology, abbreviated as B.E. / B.Tech. |
| **18OB1.2** | (a) The Programme to which students are admitted to First semester of B.E./B.Tech. Programme shall be of four academic year duration divided into eight semesters. The actual Teaching and Learning days shall be for at least 90 working days in a semester.<br>(b) The Programme to which students are admitted to third semester of B.E./B.Tech. Programme under lateral entry shall be of three academic year duration, divided into six semesters. The actual Teaching and Learning days shall be at least 90 working days in a semester.<br>(c) The Programme (conducted during evening) to which students are admitted to third semester of B.E./B.Tech. Programme under lateral entry scheme shall be of three academic year duration, divided into six semesters. The actual Teaching and Learning days shall be for at least 90 working days in a semester. The deficit contact hours of the Programme, conducted during evening on all working days, shall be compensated on all Sundays (except on general holidays). |
| **18OB1.3** | The calendar of events in respect of the Programme of study shall be notified by the University in advance. |
| **18OB1.4** | Maximum Duration for Programme Completion:<br>(a) In case of students admitted to First semester of First year B.E./B.Tech. Programme<br>(i) Students admitted to First year first semester B.E./B.Tech. shall complete the Programme within a period of eight academic years from the date of first admission, failing which they have to discontinue the Programme.<br>(ii) A student who has not obtained eligibility to third semester even after three academic years from the date of first admission to first semester shall discontinue the Programme or get readmitted to first semester of first year B.E./B.Tech. with a revised University Seat Number having the same year of admission but serial number of the student starting with SIX hundred series (6XX).<br>(iii) A student who has joined first year (to I or II semester) as a |

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| | repeater and has not obtained eligibility to third semester even after three academic years from the date of readmission to first year shall discontinue the Programme or get readmitted to first semester of first year B.E./B.Tech., subject to the provision of 18OB1.4 (a)( i), with a revised University Seat Number having the same year of admission but serial number of the student starting with SIX hundred series (6XX).<br>(iv) A student, who has been readmitted to First year as per [as per 18OB1.4 (a) (ii)and (iii)], does not get eligibility to third semester even after two academic years from the date of readmission, he/she shall discontinue the Programme or seek fresh admission following the prevailing admission procedure at that time.<br>(v) A student who gets admitted to III semester from I year in three or less the three years shall complete the Programme, with or without break, within a period of eight academic years from the date of first admission, failing which they have to discontinue the Programme or seek fresh admission following the prevailing admission procedure at that time.<br>(b) In case of lateral entry students admitted to Third semester of Second year B.E./B.Tech. Programme<br>(i) Students admitted to second year third semester B.E./ B.Tech. shall complete the Programme within a period of six academic years from the date of first admission, failing which they have to discontinue the Programme.<br>(ii) A student who has not obtained eligibility to fifth semester even after two academic years from the date of first admission to third semester shall discontinue the Programme or get readmitted to third semester of second year B.E./B.Tech. with a revised University Seat Number having the same year of admission but serial number of the student starting with SEVEN hundred series (7XX).<br>(iii) A student who has joined second year (to III or IV semester) as a repeater and has not obtained eligibility to fifth semester even after three academic years from the date of readmission to second year shall discontinue the Programme or get readmitted to third semester of second year B.E./B.Tech., subject to the provision of 18OB1.4 (b) ( i), with a revised University Seat Number having the same year of admission but serial number of the student starting with SEVEN hundred series (7XX).<br>(iv) A student, who has been readmitted to second year as per [as per 18OB1.4 (b) (ii) and (iii)], does not get eligibility to fifth semester even after two academic years from the date of readmission to second year, he/she shall discontinue the Programme or seek fresh admission following the prevailing admission procedure at that time. |

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| | (v) A student who gets admitted to V semester from II year in two or less the two years shall complete the Programme, with or without break, within a period of six academic years from the date of first admission, failing which they have to discontinue the Programme or seek fresh admission following the prevailing admission procedure at that time. |
| **18OB1.5** | Prescribed Number of Credits for the Programme [to be read along with 18OB12.2]:<br>(a) The number of credits to be completed by students admitted to first semester of B.E./B.Tech. Programme shall be 175.<br>(b) The number of credits to be completed by students admitted to third semester of B.E./B.Tech. Programme under lateral entry scheme shall be 135.<br>(c) A student shall be eligible to get Undergraduate degree with Honours, if he/she earns additional 20 credits, as per VTU norms issued from time to time regarding the earning of additional credits.[To be read along with Regulations Governing the award of Honours' at B.E./B.Tech. Degree Programmes.] |
| **18OB1.6** | (a) Definition of Credits:<br>(a.1) 1 hour Lecture (L) per week per semester =1 Credit<br>(a.2) 2 hour Tutorial (T) per week per semester =1 Credit<br>(a.3) 2 hour Practical/Laboratory/Drawing (P) per week per semester =1 Credit.<br>(a.4) Teaching – Learning hours for Credit Courses:<br>(a.5) Four credit theory courses shall be designed for 50 hours of Teaching – Learning process.<br>(a.6) Three credit theory courses shall be designed for 40 hours of Teaching – Learning process. |
| **18OB2.0** | **Eligibility for Admission to B.E./B.Tech. Programmes (As per the Government orders issued from time to time)** |
| **18OB2.1** | (a) Day Engineering College (Eligibility: Candidates who have Passed Second PUC/ Twelfth standard)<br>(i) Passed Second PUC/12th standard/Equivalent examination with English as one of the Languages and obtained a minimum of 45 % of Marks in aggregate in Physics and Mathematics along with Chemistry/Bio-Technology/ Biology/ Electronics/ Computer. 40 % for SC, ST, Category – 1, 2A, 2B, 3A and 3B category candidates of Karnataka only.<br>(ii) Those students, who have passed a qualifying examination other than the PUC II examination of the Pre-University Education Board of Karnataka, have to obtain eligibility certificate for seeking admission to B.E./B.Tech. Degree Programme from Visvesvaraya Technological University, Belagavi. |

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| | (b) Day Engineering College (Eligibility: Candidates who have Passed 3 year Diploma)<br>(i) A candidate who has passed any Engineering diploma examination or equivalent examination and obtained an aggregate minimum of 45 % marks taken together in all the subjects of the final year (Fifth and Sixth semester) diploma examination (qualified examination) is eligible for admission to B.E./B.Tech. Programmes,in respective branch of Engineering (as notified by the Government of Karnataka for admission to 3rd semester / 2nd year B.E./B.Tech.) and 40 % of marks in qualified examination in case of SC, ST and Backward Classes of Karnataka candidates.<br>(ii) Those candidates who have completed Engineering Diploma from other than Karnataka state shall provide the Equivalence/ Eligibility Certificate issued from the Director of Technical Education, Karnataka.<br>(c) Evening Engineering College (Eligibility: Candidates who have Passed 3 year Diploma):<br>(i) A candidate who has passed any Engineering diploma examination or equivalent examination and obtained an aggregate minimum of 45 % marks taken together in all the subjects of the final year (Fifth and Sixth semesters) diploma examination (qualified examination) is eligible for admission to B.E./B.Tech. Programmes, in respective branch of Engineering (as notified by the Government of Karnataka for admission to 3rd semester / 2nd year B.E./B.Tech.) and 40 % of marks in qualified examination in case SC, ST and Backward Classes of Karnataka candidates.<br>In addition to this a candidate after passing the diploma, must have minimum of Two years full-time work experience as on 1st September of the year of admission, in a registered firm/Company/Industry/Educational Institution /Government/Autonomous Organizations in the branch of Engineering/Technology, in which the candidates holds a diploma, and in which admission is sought by him/her.<br>Professional experience refers to the experience earned as an employee on regular basis in Government, Government Undertaking, Public Sector Undertaking, Corporation or Private company registered under the Directorate of Industries and Commerce or the Directorate of Small Scale Industries or Government, Government recognized Institutions as technical staff.<br>Provided that the period of apprenticeship undergone shall also be treated as professional experience , if sponsored by the Board of Apprenticeship Training, Southern Region, Chennai or by Government, Government Undertakings and Public Sector Undertakings. |

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| | **Note:** In case where genuineness of the employment certificate is questionable, such candidates have to produce supportive documents specifying the registration details of the Industry/Company (e.g., SSI Registration) and or identity cards provided to them together with latest salary certificate and provident fund certificate. However, the employer has to fill up the NOC duly signed by the company authority.<br>(d) Day Engineering College (Eligibility: Candidates who have Passed B.Sc Degree)<br>Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.<br>**Note:** A Faculty/ Employee working on Full Time basis in an Institution/ Organization and pursuing/ pursued any Full Time Course for the same duration as that of Regular Shift ("Single Shift/ Regular Shift" means where, educational activities of the Technical Institution are conducted between say, 9 am and 5 pm.) shall be considered as invalid for the purpose of employment/ higher studies.<br>However, the Faculty/ Employee shall pursue a Programme (Course) as Part Time for longer duration, in the same City, only if, a University is offering a Part Time Programme for longer duration. [Page 74, 6.1, Chapter VI, Norms and Requirements, Approval Process Handbook 2019-20] |
| **18OB2.2** | With regard to the qualification earned from foreign countries, Equivalence certificate from the University/ Association of Indian Universities is mandatory for admission to B.E./B.Tech. Programmes. In case of any dispute about the equivalence in qualification earned from foreign countries, the decision of the University Equivalence Committee shall be the final in establishing the eligibility of the student. |
| **18OB3.0** | **Courses** |
| **18OB3.1** | There shall be the following types of Courses:<br>(a) Humanities, Social Sciences and Management (HSMC): These are mandatory for all disciplines.<br>(b) Basic Sciences (BSC): Physics, Chemistry and Mathematics. These are mandatory for all disciplines.<br>(c) Engineering Sciences (ESC): Materials, Workshop, Drawing, and Basics of Electrical/ Electronics/ Instrumentation/ Civil/ Mechanical/ Computer Engineering etc. These are mandatory for all disciplines.<br>(d) Professional Courses (PCC) – Core: Are the professional Core Courses, relevant to the chosen specialization/ branch. The core Courses are to be compulsorily studied by students |

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| | and are mandatory to complete them to fulfill the requirements of a Programme.<br>(e) Professional Elective Courses (PEC): Are the professional Electives, relevant to the chosen specialization / branch and can be chosen from the pool of papers. It shall be supportive to the discipline providing extended scope/enabling an exposure to some other discipline /domain and nurturing student proficiency skills.<br>(f) Open Elective Courses (OEC): Are the Elective Courses from other technical areas and/ or from emerging fields.<br>(g) Project Work (PROJ): Mini project and Main Project. Carried out at the Institution or elsewhere without affecting with the regular classwork.<br>(h) Seminar: Deliverable at the Institution under the supervision of a Faculty.<br>(i) Internship: Preferably at an industry/R and D organization/IT company/Government organization or elsewhere of significant repute for a specified period as mentioned in Scheme of Teaching and Examinations.<br>(j) Mandatory Courses (MC): These Courses are mandatory, without the benefit of a grade or credit, for students admitted to B.E./B.Tech. Programme. A pass in each mandatory Course is required to qualify for the award of degree. |
| **18OB3.2** | The minimum number of students registered to any Elective Course offered by the Departments shall be not less than ten.<br>However, the above condition shall not be applicable to Programmes having class strength of less than 10. In such cases, only one elective course shall be offered. |
| **18OB3.3** | A student shall exercise his option in respect of Elective Course/s and registered for the same at the beginning of the concerned semester. The student may be permitted to opt for a change of Elective Course/s within 15 days from the date of commencement of the semester as per the calendar of the University. |
| **18OB3.4** | **Course Registration:**<br>In order to maintain proper academic record of each student at the Institution, every student shall register for the Courses of a semester (Credits) under the supervision of a Faculty Advisor (also called Mentor, Counselor, etc.,) in each semester. |
| **18OB4.0** | **Internship/Professional Practice** |
| **18OB4.1** | Internship / Professional Practice<br>The Internship shall be completed during the period specified in the Scheme of Teaching and Examinations.<br>1) The internship shall preferably be at an industry/R and D organization/IT company/ Government organization of |

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| | significant repute for a specified period as mentioned in Scheme of Teaching and Examinations.<br>2) The Department/college shall nominate staff member/s to facilitate, Guide and supervise students under internship.<br>3) The students shall report progress of the internship to the Guide in regular intervals and seek his/her advice. The Guide shall maintain the progress record of the candidates undergoing internship.<br>4) After the completion of Internship, students shall submit a report with completion certificate and attendance certificate to the Head of the Department with the approval of both internal and external Guides.<br>5) There shall be 40 marks for CIE and 60 marks for SEE. The minimum requirement of CIE marks shall be 50% of the maximum marks.<br>6) The internal Guide shall be the internal examiner for the SEE.<br>7) The external Guide for Internship shall be the external examiner for SEE. Examination for internship shall be conducted at the college and the date shall be fixed in consultation with the external Guide. The Examiners shall jointly award the SEE marks. [To be read along with 18OB8.9 (f)]<br>8) In case the external Guide expresses his inability to conduct the Examination, the Principal /Chief Superintendent of the Institute shall appoint a senior faculty of the Department to conduct the Examination along with the internal Guide.<br>9) Non-availability of Internal guide due to inevitable situations for the conduct of SEE, the Principal /Chief Superintendent of respective institute shall appoint a senior faculty of the Department to conduct the Examination.<br>10) The students are permitted to carry out the internship anywhere in India or abroad. The University will not provide any kind of financial assistance to any student for carrying out the Internship. |
| **18OB 5.0** | **Technical Seminar and Project** |
| **18 OB 5.1** | Technical Seminar: Technical Seminar is one of the head of passing.<br>(i) Each candidate shall deliver Technical seminar as per the Scheme of Teaching and Examinations on the topic chosen from the relevant field.<br>(ii) The Head of the Department shall make arrangements for the conduct of seminars through concerned faculty members of the Department. The committee, constituted for the purpose by the Head of the Department, shall award the CIE marks for the seminar. The committee shall consist of two senior faculty members of the Department and the senior most acting as the |

Chairperson. [To be read along with 18OB8.2 (e)]

**18OB 5.2** Project: Project (Mini and Main) is one of the head of passing.

Mini Project Work and Main Project Work shall preferably be batch wise, the strength of each batch shall not exceed a maximum of four students. [To be read along with 18OB 8.2 (f), (g) 18OB8.9 (f) and the details mentioned in Scheme of Teaching and Examinations.]

**18OB 5.3** Examinations in Mini Project Work and Main Project Work shall be conducted batch-wise.

**18OB 6.0** **Computation of SGPA and CGPA**

**18OB 6.1**

(i) The University adopts absolute grading system wherein the marks are converted to grades, and every semester results shall be declared in terms of Semester Grade Point Average (SGPA) considering all the courses appeared in that Semester End Examinations including backlog course/s/arrear papers (refers to courses other than the current semester courses that have not yet been completed), and Cumulative Grade Point Average (CGPA). The CGPA will be calculated for every semester, except for the first semester.

(ii) The grading system with the letter grades and the assigned range of marks under absolute grading system shall be as given below:

| Level | Outstanding | Excellent | Very Good | Good | Above Average | Average | Fail |
|---|---|---|---|---|---|---|---|
| Letter Grade | S | A | B | C | D | E | F |
| Grade Points | 10 | 9 | 8 | 7 | 6 | 4 | 00 |
| Percentage of Marks Scored in a Course | ≥ 90 | <90 ≥80 | < 80 ≥70 | < 70 ≥60 | < 60 ≥ 45 | < 45 ≥40 | < 40 |
| | (90 -100) | (80 - 89) | (70 - 79) | (60 - 69) | (45 - 59) | (40 - 44) | (0 - 39) |

(iii) A student obtaining Grade F in a Course shall be considered fail and is required to reappear in the subsequent SEE. Whatever the letter grade secured by the student during his /her reappearance shall be awarded. The number of attempts taken to clear Course/s shall be indicated in the grade card.

**18OB6.2** Computation of SGPA and CGPA

The following expressions shall be used to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) respectively:

$$SGPA = \frac{\sum[Course\ Credits\ \times Grade\ Points]\ for\ all\ the\ Courses\ in\ that\ Semester}{\sum[Course\ Credits]\ for\ all\ the\ Courses\ in\ that\ Semester}$$

$$CGPA = \frac{\sum[Course\ Credits\ \times Grade\ Points]\ for\ all\ Courses\ excluding\ those\ with\ F\ grades\ until\ that\ Semester}{\sum[Course\ Credits]\ for\ all\ Courses\ excluding\ those\ with\ F\ grades\ until\ that\ Semester}$$

The SGPA and CGPA shall be rounded off to 2 decimal places and reported in the grade cards.

**(a) SGPA and CGPA Calculations: An Illustrative Example for one academic year**

| Semester (Odd :I, Even: II) | Course Code | Credits | Grade | Grade Points | Credit Points | SGPA, CGPA |
|---|---|---|---|---|---|---|
| I | XX101 | 5:0:0 = 5 | B | 8 | $5 \times 8 = 40$ | SGPA $= \frac{117}{25} = 4.68$ |
| I | XX102 | 3:2:0 = 5 | Absent(F) | 0 | $5 \times 0 = 00$ | |
| I | XX103 | 3:0:0 = 3 | A | 9 | $3 \times 9 = 27$ | |
| I | XX104 | 0:1:1 = 2 | F | 0 | $2 \times 0 = 00$ | |
| I | XX105 | 4:1:0 = 5 | D | 6 | $5 \times 6 = 30$ | |
| I | XX106 | 5:0:0 = 5 | E | 4 | $5 \times 4 = 20$ | |
| | Total | 25 (18*) | Total | | 117 | |
| (18*): Total credits of the semester excluding the credits of the courses under F grade. Considered for the calculation of CGPA of the two consecutive semesters under consideration. | | | | | | |
| II | XX107 | 3:1:1 = 5 | C | 7 | $5 \times 7 = 35$ | SGPA $= \frac{157}{25} = 6.28$ |
| II | XX108 | 4:0:0 = 4 | B | 8 | $4 \times 8 = 32$ | |
| II | XX109 | 3:0:0 = 3 | D | 6 | $3 \times 6 = 18$ | |
| II | XX110 | 4:1:0 = 5 | E | 4 | $5 \times 4 = 20$ | |
| II | XX111 | 2:1:1 = 4 | A | 9 | $4 \times 9 = 36$ | CGPA $= \frac{(117 + 157)}{18 + 23} = 274/41 = 6.68$ |
| II | XX112 | 2:0:0 = 2 | F | 0 | $2 \times 0 = 00$ | |
| II | XX113 | 0:2:0 = 2 | B | 8 | $2 \times 8 = 16$ | |
| | Total | 25 (23*) | Total | | 157 | |
| (23*): Total credits of the semester excluding the credits of the courses under F grade. Considered for the calculation of CGPA of the two consecutive semesters under consideration. | | | | | | |
| If the Student secures letter grades as detailed below after reappearance to SEE, then the SGPA and CGPA shall be calculated as indicated below. | | | | | | |
| I | XX102 | 3:2:0 = 5 | D | 6 | $5 \times 6 = 30$ | SGPA (I Semester) $= \frac{(117 + 30 + 14)}{25}$ |
| I | XX104 | 0:1:1 = 2 | C | 7 | $2 \times 7 = 14$ | |
| II | XX112 | 2:0:0 = 2 | D | 6 | $2 \times 6 = 12$ | SGPA (II Semester) $= (157 + 12)/25 = 169/25 = 6.76$ |

**(b) CGPA Calculation of the Programme: An Illustrative Example**

| Semester | I | II | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|
| Credits of the semester | 20 | 20 | 24 | 24 | 25 | 24 | 20 | 18 |
| SGPA | 7.00 | 8.50 | 9.20 | 6.86 | 8.18 | 7.73 | 8.68 | 9.40 |

CGPA

$$= \frac{20 \times 7.00 + 20 \times 8.50 + 24 \times 9.20 + 24 \times 6.86 + 25 \times 8.18 + 24 \times 7.73 + 20 \times 8.68 + 18 \times 9.40}{175}$$

$= 8.16$

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| **180B6.3** | Grade Card: Based on the secured letter grades, grade points, SGPA and CGPA, a grade card for each semester and a consolidated grade card indicating the performance in all semesters shall be issued. |
| **18OB7.0** | **Conversions of CGPA into Percentage of marks and Class Equivalence** |
| **18OB7.1** | Formula for the conversion of CGPA into percentage of marks.<br>Percentage of marks secured, P = [CGPA Earned - 0.75] × 10<br>Illustration for a CGPA of 8.20:<br>P = [CGPA Earned 8.20 - 0.75]× 10 = 74.5 % |
| **18OB7.2** | Class Equivalence:<br>Subsequent to the conversion of final CGPA, after successful completion of the Programme, into percentage of marks (P), a graduating student is reckoned to have passed in<br>(i) First Class with Distinction (FCD) if P ≥70%<br>(ii) First Class (FC) if P ≥60% but <70% and<br>(iii) Second Class (SC) if P < 60%. |
| **18OB8.0** | **Continuous Internal Evaluation, Semester End Evaluation and Minimum CIE and SEE Marks** |
| **18OB8.1** | Continuous Internal Evaluation Marks and Minimum CIE Marks:<br>(a) For Vyavaharika Kannada (Balake Kannada)/Aadalitha Kannada (Samskruthika Kannada) the maximum CIE marks shall be 100. For the award of credit, the minimum CIE marks to be secured shall be 40 % of the maximum marks i.e., 40 marks.<br>(b) For Project work phase -1 and Technical seminar the maximum CIE marks shall be 100. For the award of credit, the minimum CIE marks to be secured shall be 50 % of the maximum marks i.e., 50 marks.<br>(c) For Practical/ Mini-project/Internship/Project work– Phase 2 the maximum CIE marks shall be 40. To appear for the SEE, the minimum CIE marks to be secured shall be 50 % of the maximum marks i.e., 20 marks.<br>(d) For all other theory Courses of the Programme, the maximum CIE marks shall be 40. To appear for the SEE, the minimum CIE marks to be secured shall be 40 % of the maximum marks i.e., 16 marks.<br>(f) For Additional Mathematics I and II (to be completed by diploma lateral entry students) the maximum CIE marks shall be 40. To appear for the SEE, the minimum CIE marks to be secured shall be 40 % of the maximum marks i.e., 16 marks.<br>(g) For Engineering Graphics and Elements of Civil Engineering and Mechanics (of First Year Engineering and to be completed by B.Sc graduates under lateral entry)the |

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| | maximum CIE marks shall be 40. To appear for the SEE, the minimum CIE marks to be secured shall be respectively 50 % and 40 % of the maximum marks i.e., 20 and 16 marks. |
| **18OB8.2** | Continuous Internal Evaluation Procedure: [To be read along with 18 OB 8.1and 8.3]<br>(a) Theory Courses:<br>(i) CIE Marks in each theory Course [including 'Technical English I and II', 'Constitution of India, Professional Ethics and Cyber Law', 'Environmental Studies', 'Additional Mathematics I and II'], shall be the sum of marks prescribed for tests and assignments. Marks prescribed for tests shall be 30 and that for assignments 10.<br>(ii) The CIE marks awarded for tests in the theory Courses shall be based on three tests generally conducted at the end of fifth, tenth and fifteenth week of each semester. Each test shall be conducted for a maximum of 50 marks and the final test marks shall be the average of three tests, proportionately reduced to a maximum of 30 marks.<br>(iii) The remaining 10 marks shall be awarded based on the evaluation of assignments/unit tests/written quizzes that support to cover both lower and higher order thinking skills as per Revised Bloom's Taxonomy.<br>(iv) Final CIE marks awarded shall be the sum of 18OB8.2<br>**(a) (ii) and (iii) for a maximum of 40 marks.**<br>(v) The candidates shall write the tests, assignments/unit-tests /written quizzes in Blue Books which shall be preserved by the Principal/ Head of the Department for at least six months after the announcement of University results and shall be made available for verification at the direction of the Registrar (Evaluation).<br>**(b) Engineering Graphics/ Drawing/Fieldwork Courses:**<br>The CIE marks awarded for I year Engineering Graphics Course shall be based on<br>(i) Classwork for 24 marks (sketching and Computer Aided Engineering Drawing).<br>(ii) Two Tests conducted in the same pattern as that of SEE for 16 marks (The marks secured can be taken as best of the two tests).<br>(iii) Final CIE marks awarded for Engineering Graphics shall be the sum of 18OB8.2 (b) (i) and (ii) for a maximum of 40 marks.<br>(iv) The CIE marks awarded for higher semester Drawings/ Design Drawings offered by various branches shall be based on the evaluation of the sheets and one test in the ratio 60:40. |

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| | (v) The CIE marks awarded for field work (like Surveying Practice) shall be based on the evaluation of the associated field work and one test in the ratio 60:40.<br><br>**(c) Practical Courses:**<br><br>The CIE marks awarded in case of Practical, shall be based on the weekly evaluation of laboratory journals/ reports after the conduction of every experiment and one practical test in the ratio 60:40.<br><br>**(d) Internship:**<br><br>The CIE marks awarded for internship shall be based on the evaluation of Internship Report, Presentation skill and Question and Answer session in the ratio 50:25:25.<br><br>**(e) Technical Seminar**<br><br>The CIE marks awarded for Technical Seminar shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.<br><br>**(f) Mini - Project**<br><br>The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Mini - Project report shall be the same for all the batch mates.<br><br>**(g) Main Project Work**<br><br>**(i) Project Work Phase – 1**<br><br>The CIE marks awarded for project work phase -1 shall be based on the evaluation of project work phase -1 Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.<br><br>**(ii) Project Work Phase - 2**<br><br>The CIE marks awarded for project work phase -2 shall be based on the evaluation of project work phase -2 Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Project report shall be the same for all the batch mates.<br><br>(h) Vyavaharika Kannada (Balake Kannada)/Aadalitha Kannada (Samskruthika Kannada)<br><br>(i) CIE Marks in Vyavaharika Kannada (Balake Kannada)/Aadalitha Kannada (Samskruthika Kannada) shall be the sum of marks prescribed for tests and assignments. Marks prescribed for tests shall be 75 and that for the assignments be 25. |

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| | (ii) The CIE marks awarded for the tests shall be based on three tests generally conducted at the end of fifth, tenth and fifteenth week of each semester. Each test shall be conducted for a maximum of 25 marks and the final CIE marks shall be the sum of the marks of all the three tests.<br>(iii) The remaining 25 marks shall be awarded based on the evaluation of assignments/oral discussions/ quizzes that supports communication skills.<br>(iv) Final marks awarded shall be the sum of 18OB8.2 (h) (ii) and (iii) for a maximum of 100 marks.<br>(v) Students shall write the tests in Blue Books and complete the exercises/activates/ questions given in the University Kannada textbook. These shall be preserved by the Principal/ Head of the Department for at least six months after the announcement of University results and shall be made available for verification at the direction of the Registrar (Evaluation). |
| **18OB8.3** | (a) The CIE marks in the case of Internship/Technical Seminar/Mini-Project and Project Work Phase 1 and 2 shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.<br>(b) A committee constituted by the Head of the Department of Humanities and Social Science shall inspect and authenticate the award the CIE marks for the Course Vyavaharika Kannada (Balake Kannada)/Aadalitha Kannada (Samskruthika Kannada). The committee shall consist of two senior faculty members of the Department and the senior most acting as the Chairperson. |
| **18OB8.4** | (i) Students satisfying the attendance requirement but failing to secure the minimum percentage of CIE marks, in any Course/s, shall not be eligible for the SEE conducted by the University and they shall be considered as fail in that Course /those Courses. However, they can appear for University examinations conducted in other Courses of the same semester and backlog Course/s if any.<br>(ii) Students who have satisfied the attendance requirement but not the CIE requirements shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.<br>(iii) Each appearance to SEE to complete a course shall be treated as an attempt. |
| **18OB8.5** | CIE marks of those students, who come under 18OB8.4, shall also be sent to the Registrar (Evaluation) along with other course CIE Marks. |

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| **18OB8.6** | (i) The final list, incorporating corrections (if any), of CIE marks awarded to the students in the Theory/Practical/Internship/ Technical Seminar / Mini – Project/Project work –phase 1 and 2, shall be displayed on the notice board of the college much before the closure of the semester.<br>(ii)The institution shall enter the CIE marks of each semester in the format of the VTU online CIE marks portal and submit a certified copy of the same to the University Examination Section within the stipulated date notified by University. Every page of the CIE marks sheet (hardcopy) shall bear the signatures of the concerned Teacher/Teachers, Head of the Department and Principal. |
| **18OB8.7** | Any corrections or overwriting of CIE marks shall bear the signature(s) of concerned Teacher(s) and in such cases the Head of the Department shall indicate the number of corrections on every sheet and attest it with his/her signature. |
| **18OB8.8** | CIE marks shall reach the University before the commencement of examination as per the notification from the office of the Registrar (Evaluation) from time to time. After the submission of CIE marks to the University, any request under any circumstances for change of CIE marks shall not be considered. |
| **18OB8.9** | Semester End Examination Marks and Passing standards<br>(a) University examination for all Courses under SEE shall be conducted for a maximum of 100 Marks. The marks secured by the students for 100 marks shall be proportionately reduced to a maximum of 60 marks to add the same with the CIE marks for the award of letter grade.<br>(b) The University examinations for all the Programmes of study shall be conducted at the end of each semester for all the eight semesters.<br>(c) Students having no backlog course/s, may not have more than one examination on the same day. However, students having backlog course/s may face a situation where they may have<br>(i) Two examinations scheduled at the same time of the day,<br>(ii) to take two examinations on the same day, one during the morning session and the other in the afternoon session, and<br>(iii) Examinations on consecutive days.<br>As changing the examination dates is not an option, the examination timetable shall not be modified/ altered/ adjusted in any of the above three cases. In the first case, the students shall select any one of the clashing courses and in second and third cases, the students shall manage the examinations as per their decision.<br>(d) The pattern of the SEE question paper for Courses Technical English I and II, Constitution of India, Professional Ethics and Cyber Law, and Environmental Studies shall be objective type [Multiple Choice Questions (MCQ)]. |

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| | (e) For a pass in a theory Course/Drawing, students shall secure a minimum 35 % of the maximum marks prescribed for the University examination and in total 40 % of the Course maximum marks, i.e., the sum of the CIE and SEE marks prescribed for the Course.<br>(f) For a pass in Practical/ Mini-project / Internship/Technical Seminar/Project work, students shall secure a minimum of 40 % of the Course maximum marks prescribed for the University examination (SEE).<br>(g) Students who satisfy the conditions 18OB8.9 (e) and (f), and obtain any grade from S to E in a Course shall be considered to have passed that Course.<br>(h) A student shall be declared fail if the candidate<br>(h.a) Fails to satisfy the conditions 18OB8.9 (g).<br>(h.b) Absents himself / herself to the University examination.<br>(h.c) Is held guilty of examination malpractice and for any other reasons, and declared the performance of any Course/s null and void by a competent authority.<br>(i) If a student secures F grade in any of the Course/s, he/she shall reappear for that Course/s during the subsequent SEE. The CIE marks awarded to the student at first attempt in the concerned Course/s shall be carried forward. Revised CIE marks is considered only in cases under the provision of 18OB8.4 (ii). |
| **18OB8.10** | Students who pass a Course of a semester as per 18OB8.9 (g) shall not be allowed to appear for any individual Course again, unless they opt for rejection of results of entire semester. However, students who have CGPA less than 5.00 at the end of academic Programme, subject to the provision 18OB1.4, shall be allowed to appear for only SEE of Course/s to make up the deficiency in CGPA. |
| **18OB8.11** | A student may, at his/her desire, can reject the total performance of a semester (including CIE marks) or reject only the result of his/her performance in University examinations of a semester. The rejection is permitted only once during the entire Programme of study. |
| **18OB8.12** | Students who desire to reject the SEE results of a semester shall reject the total performance (irrespective of the earned Course grades) in all the Courses of the semester either rejecting or retaining the CIE marks. However, rejection of the performance of VIII semester project shall not be permitted.<br>(i) Students, who desire to reject the total SEE performance of an odd or even semester including CIE marks, have to repeat that odd or even semester of the prevailing scheme by taking readmission during the subsequent academic year/s. They shall also be governed by 18OB 12.1, 12.2 and 1.4. |

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| | (ii) If the rejection of SEE results excluding CIE marks is of odd semester, students shall be allowed to take admission to the immediate next even semester.<br>(iii) If the rejection of SEE results excluding CIE marks is of even semester, then students shall not be allowed to take admission to the next odd semester as per 18OB10.3. In such cases, students shall take admission to the next odd semester of the prevailing scheme during the subsequent academic year/s, after obtaining the eligibility to move to higher semester. They shall also be governed by 18OB 12.1, 12.2 and 1.4.<br>(iv) Readmission to odd/even semester as per 18OB8.12 (i)and (iii) shall not be considered as fresh admission and therefore students shall continue to have the same University Seat Number, which was allotted earlier. The maximum duration of the programme (as per 18OB1.4) shall be counted with reference to old University Seat Number.<br>(v) Applications for rejection and approval to reappear for University examinations shall be sent to the Registrar (Evaluation) through the Principal of the College within 30 days from the date of announcement of the results. Late submission of applications shall not be accepted for any reasons.<br>(vi) Application for approval of readmission shall be sent to the Registrar through the Principal of College within 30 days from the date of the announcement of the results. Late submission of application shall not be accepted for any reasons. |
| **18OB8.13** | Students who opt for rejection of results of University examination shall be eligible for the award of degree and not for the award of ranks and Honours Degree. |
| **18OB9.0** | **Attendance Requirement** |
| **18OB9.1** | Each semester shall be considered as a unit for calculation of the attendance and the Candidates have to put in a minimum attendance of 85% in each Course with a provision of condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendations of the Principal of the college where the candidate is studying, based on medical grounds, participation in University/State/ National/ International level sports and cultural activities, seminars, workshops, paper presentation etc., of significant value. The supporting documents for condoning the shortage of attendance shall be submitted along with the recommendations. |
| **18OB9.2** | (a) The basis for the calculation of attendance shall be the period prescribed by the University by its calendar of events and as notified by the Registrar (Evaluation) from time to time. |

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| | (b) In case of late admissions, approved by competent authority (DTE/VTU), to I semester/ III semester (lateral entry scheme) of day college/III semester (lateral entry scheme) of Engineering Programme conducted during evening, the attendance shall be reckoned from the date of admission to the Programme. |
| **18OB9.3** | The Course Instructor/ Mentor/College shall inform the students as well as their parents /guardians about the attendance status periodically. Students who are facing the shortage of attendance shall be mentored to make up the shortage. Principals shall also notify every month, the list of candidates who are under short of attendance. |
| **18OB9.4** | A candidate, who does not satisfy the attendance requirement (in one or more Courses and including the Courses Additional Mathematics I and II) as mentioned in 18OB 9.1 shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year. |
| **18OB10.0** | **Vertical Progression (Promotion/ Eligibility to higher semesters)** |
| **18OB10.1** | There shall be no restriction for promotion from an odd semester to the next even semester, provided the student has fulfilled the attendance requirement. |
| **18OB10.2** | Along with the reasons specified at 18OB8.9 (h), a student shall be declared fail if he/she<br>(i) Has not satisfied the CIE requirements of any Course/s.<br>(ii) Has not registered for the SEE even after satisfying the attendance and CIE requirements. |
| **18OB10.3** | (A) Vertical Progression in case of students admitted to First year:<br>(a) Students having not more than four F grades in the two semesters of first year of the Programme shall be eligible to move to second year.<br>(a.1) Students having not more than four F grades in the four semesters of I and II year shall be eligible to move to III year.<br>(a.2) Student who have earned all the prescribed credits of I year, and having not more than four F grades in the four semesters of II and III year shall be eligible to move to IV year.<br>(B) Vertical Progression in case of Diploma students admitted to Second year (lateral entry)<br>(a) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II) in the two semesters of II year of the Programme shall be eligible to move to III Year. |

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| | (a.1) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II, if any) in the four semesters of II and III year shall be eligible to move to IV year.<br>(b) The mandatory non – credit Courses Additional Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of B.E./B.Tech. Programmes, shall attend the classes during the respective semesters to satisfy attendance and CIE requirements and to appear for the University examinations.<br>(i) In case, any student fails to satisfy the attendance requirement of the Courses Additional<br>Mathematics I and II, he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.<br>(ii) Students who have satisfied the attendance requirement but not the CIE requirements of the Courses Additional Mathematics I and II shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.<br>(c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree.<br>(C) Vertical Progression in case of B.Sc students admitted to Second year (lateral entry)<br>(a) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Design, and Civil Engineering and Mechanics of First Year Engineering Programme) in the two semesters of II year of the Programme shall be eligible to move to III Year.<br>(a.1) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Design, and Civil Engineering and Mechanics of First Year Engineering Programme, if any) in the four semesters of II and III year shall be eligible to move to IV year.<br>(b) The prescribed mandatory non – credit Courses Engineering Graphics and Design, and Civil Engineering and Mechanics of First Year Engineering Programme to lateral entry B.Sc. holders admitted to III semester of B.E./B.Tech. Programmes, shall attend the classes during the respective semesters to complete CIE and attendance requirements and to appear for the University examinations.<br>(i) In case, any student fails to satisfy the attendance requirement of the above said Courses, he/she shall not be eligible to appear for the Semester End Examinations of that semester |

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| | and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.<br>(ii) Students who have satisfied the attendance requirement but not the CIE requirements of the above said Courses, shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.<br>(c) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics shall be mandatory for the award of degree.<br>The Principal of each college shall make suitable arrangements in the timetable to facilitate the B.Sc students to attend the above mentioned courses to satisfy the CIE and attendance requirements and to appear for the University examinations. |
| **18OB11.0** | **Award of Degree** |
| **18OB11.1** | 1. B.E./B.Tech. degree<br>(a) Students shall be declared to have completed the Programme of B.E. / B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits as per the provision 18OB1.5. [To be read along with 18 OB 12.1 and 12.2]<br>(b) For the award of degree, a CGPA $\geq$ 5.00 at the end of Programme shall be mandatory. [To be read with 18OB11.2 (1)]<br>(c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.<br>(d) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme shall be mandatory for the award of degree to lateral entry B.Sc graduates.<br>(e)(i) Over and above the academic credits, every Day College regular student admitted to the 4 years Degree Programme and every student entering 4 years Degree Programme through lateral entry, shall earn 100 and 75 Activity Points respectively through AICTE Activity Point Programme for the award of degree. Students transferred from other Universities/ Autonomous colleges under VTU to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eight semester Grade Card. |

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| | (ii) Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.<br>In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.<br>**2. B.E./B.Tech. (Honours) degree**<br>(a) A student shall be declared to have completed the Programme of B.E. / B.Tech. degree and shall be eligible to get undergraduate BE/B.Tech degree with Honours, provided<br>(i) The student has undergone the stipulated Course work of all the semesters under the same Scheme of Teaching and Examinations and has earned the prescribed number of credits as per the provision 18 OB1.5 (a) and (b).<br>(ii) Has earned additional 20 or more credits through University approved online Courses.<br>(iii) Satisfies the Regulations Governing the award of Honours at B.E./B.Tech. Degree Programmes. |
| **18OB11.2** | (1)Noncompliance of CGPA at the end of the Programme<br>(a) Students who have completed all the courses of the Programme but not having a CGPA ≥ 5.00 at the end of the programme, shall not be eligible for the award of the degree.<br>(b) In the cases of 18OB11.2 (1) (a), students shall be permitted to appear again for SEE in course/s [other than Internship, Technical seminar, Project (Mini and Main), and Laboratories] of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of maximum duration of the Programme to make up the CGPA equal to or greater than 5.00 for the award of the Degree.<br>(c) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 18OB11.2(1) (b).<br>(d) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is ≥ 5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 18OB11.2 (1) (b). |

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| | (e) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is ≥ 5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 18OB11.2 (1) (b).<br>(f) In case, the students fail (i.e., earns F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 18OB11.2 (1) (b).<br>(g) Students shall obtain written permission from the Registrar (Evaluation) to reappear in SEE to make up the CGPA equal to or greater than 5.00.<br>**(2) Noncompliance of Mini-project**<br>(a) The mini-project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the mini-project shall be declared fail in that course and shall have to complete the same during subsequent University examinations after satisfying the Mini-project requirements. Also, mini-project shall be considered for eligibility to VII semester.<br>**(3) Noncompliance of Internship**<br>(a) All the students of B.E./B.Tech. shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credits shall be included with the credits of VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail in that Course and shall have to complete the same during subsequent University examinations after satisfy the internship requirements. |
| **18OB12.0** | **Temporary Discontinuation/Break in the Programme/Change in Scheme of Study** |
| **18OB12.1** | **(a)** If a candidate, for any reason, temporarily discontinues the Programme or take a break from the Programme during any semester intentionally, he/she shall be permitted to continue the Programme by registering to the same semester of the prevailing scheme. The candidate, from that semester, shall attend and complete all the remaining Course works of all the semesters, adhering to the regulations of the prevailing |

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| | scheme and subject to the provision 18OB1.4. Also the Candidates may have to complete additional Course/s, if any, as per the decision of concerned Board of Studies on establishing the equivalence between two schemes. A Grade card shall be issued to that effect. Additional Course/s shall not be considered for the eligibility criteria prescribed for promotion. Based on the individual cases, they shall be considered to decide the SGPA and CGPA to admit the student for the award of degree. Such candidates shall not be eligible for the award of rank / Honours degree.<br>(b) Candidates who take admission to any semester of the existing scheme from another scheme, as a repeater/fresher because of various reasons, shall attend and complete all the remaining semester/s of the Programme adhering to the regulations of the prevailing scheme, and shall complete additional Course/s, if any, as per the decision of concerned Board of Studies on establishing the equivalence between two schemes. A Grade card shall be issued to that effect. Additional Courses shall not be considered for the eligibility criteria prescribed for promotion. Based on the individual cases, they shall be considered to decide the SGPA and CGPA to admit the student for the award of degree. Such candidate shall not be eligible for the award of rank/Honours Degree.<br>(c) The credits to be earned by the candidates under 18OB12.1 (a and b) and 18OB14.1(b) and (c) shall be decided by the University along with the additional Course/s to be completed. |
| **18OB12.2** | **(i)** The candidates who have temporarily discontinued the Programme of study or changed the scheme of study from one to another because of various reasons, or transferred from autonomous/other University to non-autonomous VTU constituent/affiliated college, shall be eligible for the award of degree provided the credits earned is equal to or greater than the credits decided by the University in the individual cases.<br>(ii) In case, the credits earned is less than the credits decided by the University in the individual cases, after the completion of all the semesters of the Programme under the prevailing scheme, the candidate shall register for a Course or courses not studied earlier and make up the credits earned equal to or greater than the required for the award of degree.<br>(iii) If the earned Programme credits are greater than the prescribed, the CGPA shall be proportionately reduced to the prescribed Programme credits. |
| **18OB13.0** | **Award of Prizes, Medals and Ranks** |
| **18OB13.1** | For the award of Prizes and Medals, the conditions stipulated by the |

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| | Donor shall be considered subject to the provisions of the statutes framed by the University for such awards. |
| **18OB13.2** | (1) For award of rank in a Specialization of Bachelor of Engineering/ Technology, the CGPA secured by the students from III to VIII semester shall be considered.<br>(2) The additional credits earned for the award of Honours degree shall not have any bearing for the Rank declaration.<br>(3) A student shall be eligible for a rank at the time of award of degree of Bachelor of Engineering/ Technology, provided that the student,<br>(a) (i) Has passed all the Courses of I to VIII semester in first attempt only in case of Candidates admitted to I year.<br>(ii) Has passed all the Courses (including Additional Mathematics I and II in case Diploma students/ Engineering Graphics and Elements of Civil Engineering and Mechanics in case of B.Sc graduates under lateral entry) of III to VIII semester in first attempt only in case of Candidates admitted under lateral entry scheme.<br>(b) Is not a repeater in any semester because of rejection of result of a semester/ shortage of attendance etc.<br>(c) Has completed all the Courses/semesters of the same Scheme of Teaching and Examinations without any break/discontinuity.<br>(d) Has completed all the semesters (I to VIII/III to VIII) in VTU constituent college or in any VTU affiliated non-autonomous college.<br>(e) Has not been transferred from any autonomous institution affiliated to VTU or from any other University.<br>(4) The total number of ranks awarded shall be 10% of total number of students appeared in VIII semester subject to a maximum of 10 ranks in a Specialization.<br>(5) For award of ranks in a Specialization, a minimum of 10 students should have appeared in the VIII semester examination.<br>**Illustration:**<br>(a) If 1228 students appeared for the VIII semester in Electronics and Communication Engineering Programme, the number of ranks to be awarded for Electronics and Communication Engineering shall be 10.<br>(b) If 90 students appeared for the VIII semester in Biomedical Engineering, the number of ranks to be awarded for Biomedical Engineering will be 09.<br>(6) In case of fractional number of ranks, it is rounded to higher integer only when the first decimal place is greater than or equal to 5. |

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| **18OB13.3** | Ranks shall be awarded based on the merit of the students as determined by CGPA. If two or more students get the same CGPA, the tie shall be resolved by considering the number of times a student has obtained higher SGPA. If it is not resolved even at this stage, the number of times a student has obtained higher grades like S, A, B etc., shall be taken into account to decide the order of the rank. |
| **18OB14.0** | **Transfer of students** |
| **18OB14.1** | (a) (i) Transfer of students from one VTU affiliated non – autonomous college to another VTU non – autonomous affiliated college shall be permitted only at the beginning of third, fifth, and seventh semesters, subject to availability of seats within the permitted intake in respective Colleges with the approval of the Registrar, VTU subject to the provision 18OB10.3.<br>(ii) The students seeking transfer as per 18OB14.1 (a) (i) shall have to obtain No Objection certificate for admission from the University and from both the colleges before the commencement of term as notified by VTU.<br>(iii) Complete the Programme subject to the provision 18OB1.4.<br>(b) Transfer of students from an autonomous to non – autonomous college, affiliated to VTU is permitted with the following conditions.<br>(i) Transfer shall only be at the beginning of III and V semester B.E./B.Tech. Programme.<br>(ii) No transfer shall be permitted to VII semester B.E./B.Tech. Programme.<br>(iii) Students who are seeking transfer must have passed in all the Courses of the previous semesters.<br>(iv) Obtain No Objection certificate for admission from the University and from both the colleges before commencement of term as notified by VTU.<br>(v) Complete additional Course/s, if any, as per the decision of concerned Board of Studies on establishing the equivalence between two schemes. A Grade card shall be issued to that effect. Additional Course/s shall not be considered for the Eligibility criteria prescribed for promotion, calculation of SGPA and CGPA. However, a pass in the additional Courses, if any, is mandatory before the completion of Degree.<br>(vi) Earn the credits decided by the University as per 18 OB 12.2.<br>(vii) Complete the Programme subject to the provision 18OB1.4. |

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| | (c) In the case of students seeking transfer from Universities other than VTU, the students must have passed in all the Courses of I and II semesters for admission to III semester and all the Courses of I to IV semesters for admission to V semester. No transfer shall be permitted to VII semester B.E./B.Tech. Programme of VTU from any other Universities.<br>The students seeking admission from other Universities to VTU shall have to<br>(i) Apply for establishment of equivalence with prescribed fees as notified by the VTU and obtain No Objection certificate for admission from the University before the commencement of term as notified by VTU.<br>(ii) Produce No Objection certificate for admission from both the colleges before the commencement of term as notified by VTU.<br>(iii) Complete additional Course/s, if any, as per the decision of concerned Board of Studies on establishing equivalence between two schemes. A Grade card shall be issued to that effect. Additional Course/s shall not be considered for the eligibility criterion prescribed for promotion, calculation of SGPA and CGPA. However, a pass in the additional Courses, if any, is mandatory before the completion of Degree.<br>(iv) Earn the credits as decided by the University as per 18 OB 12.2.<br>(v) Complete the Programme subject to the provision 18OB1.4. |
| **18OB14.2** | Transfer of students within the College from one branch to another branch at the start of III semester shall be permitted with the approval of the Registrar, VTU subject to the provisions made by the appropriate authorities. |
| **18OB14.3** | The University may prescribe fee for administration purpose, which shall be notified from time to time, for transfer from one college to another (Change of College) or one branch to another branch (change of branch within the college). |
| **18OB15.0** | **Applicability and Power to Modify** |
| **18OB15.1** | The regulations governing the Degree of Bachelor of Engineering / Technology of Visvesvaraya Technological University shall be a binding on all concerned. |
| **18OB15.2** | i) Notwithstanding anything contained in the foregoing, the University shall have the power to issue directions/ orders to address any difficulty.<br>ii) Nothing in the foregoing may be construed as limiting the power of the University to amend, modify or repeal any or all of the above. |

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

**Programme: B.E: Electronics & Communication Engineering**

**III SEMESTER**

| Sl. No | Course and Course Code | | Course Title | Teaching Department | Teaching Hours/Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | BSC | 18MAT31 | Transform Calculus, Fourier Series and Numerical Techniques | Mathematics | 2 | 2 | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18EC32 | Network Theory | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18EC33 | Electronic Devices | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PCC | 18EC34 | Digital System Design | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | PCC | 18EC35 | Computer Organization & Architecture | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18EC36 | Power Electronics & Instrumentation | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 7 | PCC | 18ECL37 | Electronic Devices & Instrumentation Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | PCC | 18ECL38 | Digital System Design Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | HSMC | 18KVK39/49 | Vyavaharika Kannada (Kannada for Communication)/ | HSMC | -- | 2 | -- | -- | 100 | -- | 100 | 1 |
| | | 18KAK39/49 | Aadalitha Kannada (Kannada for Administration) | | | | | | | | | |
| | | OR | | | | | | | | | | |
| | | 18CPC39/49 | Constitution of India, Professional Ethics and Cyber Law | | 1 | -- | -- | 02 | 40 | 60 | | |
| | | | | | Examination is by objective type questions | | | | | | | |
| | | | **TOTAL** | | **17 OR 18** | **10 OR 08** | **04** | **24 OR 26** | **420 OR 360** | **480 OR 540** | **900** | **24** |

**Note:** BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

**Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | NCMC | 18MATDIP31 | Additional Mathematics - I | Mathematics | 02 | 01 | -- | 03 | 40 | 60 | 100 | 0 |

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.
(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

**Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs**

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

**AICTE Activity Points to be earned by students admitted to BE/B. Tech/B. Plan day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines):**

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**

**Scheme of Teaching and Examination 2018 – 19**

**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

**(Effective from the academic year 2018 – 19)**

**Programme: B.E: Electronics & Communication Engineering**

**IV SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | BSC | 18MAT41 | Complex Analysis, Probability and Statistical Methods | Mathematics | 2 | 2 | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18EC42 | Analog Circuits | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18EC43 | Control Systems | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PCC | 18EC44 | Engineering Statistics & Linear Algebra | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | PCC | 18EC45 | Signals & Systems | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18EC46 | Microcontroller | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 7 | PCC | 18ECL47 | Microcontroller Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | PCC | 18ECL48 | Analog Circuits Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | HSMC | 18KVK39/49 | Vyavaharika Kannada (Kannada for Communication) | HSMC | -- | 2 | -- | -- | 100 | -- | 100 | 1 |
| | | 18KAK39/49 | Aadalitha Kannada (Kannada for Administration) | | | | | | | | | |
| | | **OR** | | | | | | | | | | |
| | | 18CPC39/49 | Constitution of India, Professional Ethics and Cyber Law | | 1 | -- | -- | 02 | 40 | 60 | | |
| | | | | | Examination is by objective type questions | | | | | | | |
| | | | | **TOTAL** | **17 OR 18** | **10 OR 08** | **04** | **24 OR 26** | **420 OR 360** | **480 OR 540** | **900** | **24** |

**Note:** BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39/49 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and
18KAK39/49 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

**Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | NCMC | 18MATDIP41 | Additional Mathematics – II | Mathematics | 02 | 01 | -- | 03 | 40 | 60 | 100 | 0 |

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

**Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs**

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

**Programme: B.E: Electronics & Communication Engineering**

**V SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | HSMC | 18ES51 | Technological Innovation Management and Entrepreneurship | | 3 | 0 | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18EC52 | Digital Signal Processing | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18EC53 | Principles of Communication Systems | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 4 | PCC | 18EC54 | Information Theory & Coding | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | PCC | 18EC55 | Electromagnetic Waves | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18EC56 | Verilog HDL | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 7 | PCC | 18ECL57 | Digital Signal Processing Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | PCC | 18ECL58 | HDL Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | HSMC | 18CIV59 | Environmental Studies | Civil/Environmental [Paper setting: Civil Engineering Board] | 1 | -- | -- | 02 | 40 | 60 | 100 | 1 |
| | | | | **TOTAL** | **19** | **8** | **4** | **26** | **360** | **540** | **900** | **25** |

**Note:** PCC: Professional Core, HSMC: Humanity and Social Science.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2018 – 19)**

**Programme: B.E: Electronics & Communication Engineering**

**VI SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18EC61 | Digital Communication | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 2 | PCC | 18EC62 | Embedded Systems | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 3 | PCC | 18EC63 | Microwave and Antennas | | 3 | 2 | -- | 03 | 40 | 60 | 100 | 4 |
| 4 | PEC | 18XX64X | Professional Elective -1 | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | OEC | 18XX65X | Open Elective -A | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18ECL66 | Embedded Systems Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 7 | PCC | 18ECL67 | Communication Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | MP | 18ECMP68 | Mini-project | | -- | -- | 2 | 03 | 40 | 60 | 100 | 2 |
| 9 | Internship | -- | Internship | To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters. | | | | | | | | |
| | | | | **TOTAL** | **15** | **10** | **6** | **24** | **320** | **480** | **800** | **24** |

**Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.**

**Professional Elective -1**

| Course code under 18XX64X | Course Title |
|---|---|
| 18EC641 | Operating System |
| 18EC642 | Artificial Neural Networks |
| 18EC643 | Data Structures using C++ |
| 18EC644 | Digital System Design Using Verilog |
| 18EC645 | Nanoelectronics |
| 18EC646 | Python Application Programming |

| OPEN ELECTIVE group-B | |
|---|---|
| 18EC651 | Signal Processing |
| 18EC652 | Sensors &Signal Conditioning |
| **18EC653** | **Virtual Instrumentation** |
| **18EC654** | **Microcontrollers** |
| **18EC655** | **Basic VLSI Design** |

Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

**Mini-project work:**

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

**CIE procedure for Mini-project:**

**(i) Single discipline:**The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**SEE for Mini-project:**

**(i) Single discipline:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

**(ii) Interdisciplinary:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

| |
|---|
| **Internship:** All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. |
| **AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. |

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**Scheme of Teaching and Examination 2018 – 19**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
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**Programme: B.E: Electronics & Communication Engineering**

**VII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18EC71 | Computer Networks | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PCC | 18EC72 | VLSI Design | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 3 | PEC | 18XX73X | Professional Elective - 2 | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 4 | PEC | 18XX74X | Professional Elective - 3 | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 5 | OEC | 18XX75X | Open Elective -B | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 6 | PCC | 18ECL76 | Computer Networks Lab | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 7 | PCC | 18ECL77 | VLSI Laboratory | | -- | 2 | 2 | 03 | 40 | 60 | 100 | 2 |
| 8 | Project | 18ECP78 | Project Work Phase - 1 | | -- | -- | 2 | -- | 100 | -- | 100 | 1 |
| 9 | Internship | -- | Internship | (If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters) | | | | | | | | |
| | | | | **TOTAL** | **15** | 04 | **06** | **21** | **38** | **420** | **800** | **20** |

**Note:** PCC: Professional core, PEC: Professional Elective.

**Professional Elective - 2**

| **Course code under 18XX73X** | **Course Title** |
|---|---|
| 18EC731 | Real Time Systems |
| 18EC732 | Satellite Communication |
| 18EC733 | Digital Image Processing |
| 18EC734 | DSP Algorithms & Architecture |
| | |

| **Course code under 18XX74X** | **Course Title** |
|---|---|
| 18EC741 | IOT & Wireless Sensor Networks |
| 18EC742 | Automotive Electronics |
| 18EC743 | Multimedia Communication |
| 18EC744 | Cryptography |
| 18EC745 | Machine Learning with Python |
| **Open Elective –B** | |
| 18EC751 | Communication Theory |
| 18EC752 | Neural Networks |
| **18EC753** | **ARM Embedded Systems** |
| **18EC754** | **Digital Systems Design using VHDL** |
| | |

Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

**Project work:**

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

**CIE procedure for Project Work Phase - 1:**

**(i) Single discipline:**The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

| |
|---|
| The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.<br>**Internship:** All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. |
| **AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. |

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**
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**Programme: B.E: Electronics & Communication Engineering**

**VIII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18EC81 | Wireless and Cellular Communication | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PEC | 18XX82X | Professional Elective - 4 | | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 3 | Project | 18ECP83 | Project Work Phase - 2 | | -- | -- | 2 | 03 | 40 | 60 | 100 | 8 |
| 4 | Seminar | 18ECS84 | Technical Seminar | | -- | -- | 2 | 03 | 100 | -- | 100 | 1 |
| 5 | Internship | 18ECI85 | Internship | Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.) | | | | 03 | 40 | 60 | 100 | 3 |
| | | | | **TOTAL** | **06** | -- | **04** | **15** | **260** | **240** | **500** | **18** |

**Note:** PCC: Professional Core, PEC: Professional Elective.

**Professional Elective - 4**

| Course code under 18XX82X | Course Title |
|---|---|
| 18EC821 | Network Security |
| 18EC822 | Micro Electro Mechanical Systems |
| 18EC823 | Radar Engineering |
| 18EC824 | Optical Communication Networks |
| 18EC825 | Biomedical Signal Processing |

**Project Work**

**CIE procedure for Project Work Phase - 2:**

**(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**SEE for Project Work Phase - 2:**

**(i) Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

**(ii) Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

**Internship:** Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of $8^{th}$ semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

# B. E. COMMON TO ALL PROGRAMMES

**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

**SEMESTER - III**

# TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

| | | | |
|---|---|---|---|
| Course Code | : 18MAT31 | CIE Marks | : 40 |
| Lecture Hours/Week (L:T:P) | : (2:2:0) | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (8 Hrs / Module) | Exam Hours | : 03 |
| **CREDITS – 03** | | | |

**Course Learning Objectives:**

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODEs arising in engineering applications, using numerical methods.

**Module-1**

**Laplace Transforms:** Definition and Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function – problems.
**Inverse Laplace Transforms:** Inverse Laplace transform - problems, Convolution theorem to find the inverse Laplace transform (without proof) and problems, solution of linear differential equations using Laplace transform.

**Module-2**

**Fourier Series:** Periodic functions, Dirichlet's condition. Fourier series of periodic functions period $2\pi$ and arbitrary period. Half range Fourier series. Practical harmonic analysis, examples from engineering field.

**Module-3**

**Fourier Transforms:** Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.
**Difference Equations and Z-Transforms:** Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform. Simple problems.

## Module-4

**Numerical Solutions of Ordinary Differential Equations (ODEs):** Numerical solution of ODEs of first order and first degree- Taylor's series method, Modified Euler's method. Range - Kutta method of fourth order, Milne's and Adam-Bashforth predictor and corrector method (No derivations of formulae), Problems.

## Module-5

**Numerical Solution of Second Order ODEs:** Runge -Kutta method and Milne's predictor and corrector method.(No derivations of formulae).

**Calculus of Variations:** Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

**Course Outcomes:** At the end of the course the student will be able to:

1. Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
2. Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
3. Make use of Fourier transform and Z-transform to illustrate discrete/ continuous function arising in wave and heat propagation, signals and systems.
4. Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
5. Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Textbooks**

1. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, $10^{th}$ Edition, 2016
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, $44^{th}$ Edition, 2017
3. Engineering Mathematics, Srimanta Pal et al, Oxford University Press, $3^{rd}$ Edition, 2016

**Reference Books**

1. Advanced Engineering Mathematics, C. Ray Wylie, Louis C. Barrett, McGraw-Hill Book Co, $6^{th}$ Edition, 1995
2. Introductory Methods of Numerical Analysis, S. S. Sastry, Prentice Hall of India, $4^{th}$ Edition 2010
3. Higher Engineering Mathematics, B.V. Ramana, McGraw-Hill, $11^{th}$ Edition,2010
4. A Text Book of Engineering Mathematics, N. P. Bali and Manish Goyal, Laxmi Publications, 2014
5. Advanced Engineering Mathematics, Chandrika Prasad and Reena Garg, Khanna Publishing, , 2018

**Web links and Video Lectures:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

# NETWORK THEORY

| | |
|---|---|
| Course Code : 18EC32 | CIE Marks : 40 |
| Lecture Hours/Week : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | Exam Hours : 03 |
| **CREDITS : 04** | |

**Course Learning Objectives:** This course will enable students to:

- Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/ impedance, voltage, current and power.
- Explain network Thevenin's, Millman's, Superposition, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits.
- Explain the behavior of networks subjected to transient conditions.
- Use applications of Laplace transforms to network problems.
- Study two port network parameters like Z, Y, T and h and their inter-relationships and applications.
- Study of RLC Series and parallel tuned circuit.

**Module – 1**

**Basic Concepts:** Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks.

**L1, L2, L3, L4**

**Module – 2**

**Network Theorems:**

Superposition, Millman's theorems, Thevenin's and Norton's theorems, Maximum Power transfer theorem.

**L1, L2, L3, L4**

**Module – 3**

**Transient behavior and initial conditions:** Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

**L1 , L2 , L3**

**Module – 4**

**Laplace Transformation & Applications**: Solution of networks, step, ramp and impulse responses, waveform Synthesis.

**L1, L2, L3, L4**

## Module – 5

**Two port network parameters:** Definition of Z, Y, h and Transmission parameters, modelling with these parameters, relationship between parameters sets.

**Resonance:**

**Series Resonance**: Variation of Current and Voltage with Frequency, Selectivity and Bandwidth, Q-Factor, Circuit Magnification Factor, Selectivity with Variable Capacitance, Selectivity with Variable Inductance.

**Parallel Resonance:** Selectivity and Bandwidth, Maximum Impedance Conditions with C, L and f Variable, current in Anti-Resonant Circuit, The General Case-Resistance Present in both Branches.

**L1, L2, L3, L4**

**Course Outcomes:** At the end of the course, the students will be able to

1. Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/source transformation/ source shifting.
2. Solve network problems by applying Superposition/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions.
3. Calculate current and voltages for the given circuit under transient conditions and Apply Laplace transform to solve the given network.
4. Solve the given network using specified two port network parameters - Z, Y, T & h.
5. Understand the concept of resonance and determine the parameters that characterize series/parallel Resonant Circuits.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. M.E. Van Valkenburg (2000) —Network Analysis, Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958.
2. Roy Choudhury - Networks and Systems, 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677

**Reference Books:**


1. Hayt, Kemmerly and Durbin —Engineering Circuit Analysis, TMH 7th Edition, 2010.
2. J. David Irwin /R. Mark Nelms —Basic Engineering Circuit Analysis John Wiley, 8th ed, 2006.
3. Charles K Alexander and Mathew N O Sadiku — Fundamentals of Electric Circuits, Tata McGraw-Hill, 3rd Ed, 2009.

# ELECTRONIC DEVICES

| | | |
|---|---|---|
| Course Code | : 18EC33 | CIE Marks : 40 |
| Lecture Hours/Week | : 03 | SEE marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hours / Module) | | Exam Hours : 03 |
| **CREDITS – 03** | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the basics of semiconductor physics and electronic devices.
- Describe the mathematical models BJTs and FETs along with the constructional details.
- Understand the construction and working principles of optoelectronic devices
- Understand the fabrication process of semiconductor devices and CMOS process integration.

**Module-1**

**Semiconductors**

Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect.

**(Text 1: 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5).**

**L1,L2**

**Module-2**

**pn Junctions**

Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. **(Text 1: 5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3)**
Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials**.**

**(Text 1: 8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1)**, **L1,L2**

**Module – 3**

**Bipolar Junction Transistor**

Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.

**(Text 1: 7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3)** **L1,L2**

## Module-4

**Field Effect Transistors**

Basic pn JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET- Two terminal MOS structure- Energy band diagram, Ideal Capacitance – Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current-Voltage Characteristics.

**(Text 2: 9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).** **L1,L2**

## Module-5

**Fabrication of p-n junctions**

Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization.

**(Text 1: 5.1)**

**Integrated Circuits**

Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. **(Text 1: 9.1, 9.2, 9.3.1, 9.3.3).** **L1,L2**

**Course outcomes:** After studying this course, students will be able to:

1. Understand the principles of semiconductor Physics
2. Understand the principles and characteristics of different types of semiconductor devices
3. Understand the fabrication process of semiconductor devices
4. Utilize the mathematical models of semiconductor junctions for circuits and systems.
5. Identify the mathematical models of MOS transistors for circuits and systems.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices", 7th Edition, Pearson Education, 2016, ISBN 978-93-325-5508-2.
2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition, McGraw Hill Education, 2012, ISBN 978-0-07-107010-2.

**Reference Book:**

1. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3rd Edition, Wiley, 2018.
2. Adir Bar-Lev, "Semiconductor and Electronic Devices", 3rd Edition, PHI, 1993.

# DIGITAL SYSTEM DESIGN

| | | |
|---|---|---|
| Course Code : **18EC34** | | CIE Marks : 40 |
| Lecture Hours/Week : 03 | | SEE marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hours / Module) | | Exam Hours : 03 |
| **CREDITS – 03** | | |

**Course Learning Objectives:** This course will enable students to:

- Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-Mc Clusky Techniques.
- Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators.
- Describe Latches and Flip-flops, Registers and Counters.
- Analyze Mealy and Moore Models.
- Develop state diagrams Synchronous Sequential Circuits.
- Appreciate the applications of digital circuits.

**Module – 1**

**Principles of combinational logic**: Definition of combinational logic, canonical forms,

Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey techniques – 3 & 4 variables

**(Text 1 - Chapter 3)** **L1, L2, L3**

**Module – 2**

**Analysis and design of combinational logic:** Decoders, Encoders, Digital multiplexers, Adders and subtractors, Look ahead carry, Binary comparators.

**(Text 1 - Chapter 4)**

Programmable Logic Devices, Complex PLD, FPGA.

**(Text 3 - Chapter 9, 9.6 to 9.8)** **L1, L2, L3**

**Module -3**

**Flip-Flops and its Applications:** Basic Bistable elements, Latches, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Characteristic equations, Registers, binary ripple counters, and synchronous binary counters.**(Text 2 - Chapter 6)** **L1, L2, L3**

**Module -4**

**Sequential Circuit Design:** Design of a synchronous counter, Design of a synchronous mod-n counter using clocked JK, D, T and SR flip-flops.
**(Text 2 - Chapter 6)**
Mealy and Moore models, State machine notation, Construction of state diagrams. **(Text 1 - Chapter 6)** **L1, L2, L3**

**Module -5**

**Applications of Digital Circuits:** Design of a Sequence Detector, Guidelines for construction of state graphs, Design Example – Code Converter, Design of Iterative Circuits (Comparator), Design of Sequential Circuits using ROMs and PLAs, CPLDs and FPGAs, Serial Adder with Accumulator, Design of Binary Multiplier, Design of Binary Divider.
**(Text 3 – 14.1, 14.3, 16.2, 16.3, 16.4, 18.1, 18.2, 18.3)** **L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:
1. Explain the concept of combinational and sequential logic circuits.
2. Analyze and Design the combinational logic circuits.
3. Describe and characterize flip-flops and its applications.
4. Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines.
5. Design applications of Combinational & Sequential Circuits.

**Question paper pattern:**
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. John M Yarbrough -Digital Logic Applications and Design, Thomson Learning, 2001.
2. Donald D. Givone —Digital Principles and Design, McGraw Hill, 2002.
3. Charles H Roth Jr., Larry L. Kinney —Fundamentals of Logic Design, Cengage Learning, 7th Edition.


**Reference Books:**

1. D. P. Kothari and J. S Dhillon, —Digital Circuits and Design, Pearson, 2016.
2. Morris Mano, —Digital Design, Prentice Hall of India, Third Edition.
3. K. A. Navas —Electronics Lab Manual, Volume I, PHI, 5th Edition, 2015.

# COMPUTER ORGANIZATION AND ARCHITECTURE

| | | |
|---|---|---|
| Course Code | : 18EC35 | CIE Marks : 40 |
| Lecture Hours/Week | : 03 | SEE Marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hours / Module) | | Exam Hours : 03 |
| **CREDITS– 03** | | |

**Course Learning Objectives:** This course will enable students to:

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices
- Describe memory hierarchy and concept of virtual memory.
- Illustrate organization of simple pipelined processor and other computing systems.

**Module 1**

**Basic Structure of Computers:** Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation **(up to 1.6.2 of Chap 1 of Text).**

**Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing **(up to 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text). L1, L2, L3**

**Module 2**

Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions **(from 2.4.7 of Chap2, except 2.9.3, 2.11 & 2.12 of Text). L1, L2, L3**

**Module 3**

**Input/Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access
**(up to 4.2.4 and 4.4 except 4.4.1 of Chap 4 of Text). L1, L2, L3**

**Module 4**

**Memory System:** Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks **(5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 of Chap 5 of Text). L1, L2, L3**

## Module 5

**Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control **(up to 7.5 except 7.5.1 to 7.5.6 of Chap 7 of Text).**

**L1,L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Explain the basic organization of a computer system.
2. Describe the addressing modes, instruction formats and program control statement.
3. Explain different ways of accessing an input / output device including interrupts.
4. Illustrate the organization of different types of semiconductor and other secondary storage memories.
5. Illustrate simple processor organization based on hardwired control and micro programmed control.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.

**Reference Books:**

1. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
2. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
3. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

# POWER ELECTRONICS AND INSTRUMENTATION

| | | |
|---|---|---|
| Course Code | : 18EC36 | CIE Marks : 40 |
| Lecture Hours/Week : 03 | | SEE marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hrs / Module) | | Exam Hours : 03 |
| **CREDITS – 03** | | |

**Course Learning Objectives:** This course will enable students to:

- Study and analysis of thyristor circuits with different triggering conditions.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Understand types of instrument errors.
- Develop circuits for multirange Ammeters and Voltmeters.
- Describe principle of operation of digital measuring instruments and Bridges.
- Understand the operation of Transducers, Instrumentation amplifiers and PLCs.

**Module - 1**

**Introduction:** History, Power Electronic Systems, Power Electronic Converters and Applications (**1.2, 1.3 1.5 & 1.6 of Text 1).**
**Thyristors:** Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-ON methods, Turn-OFF mechanisms (**2.3, 2.6 without 2.6.1), 2.7, 2.9 of text 1**),
Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types (**refer 2.10 without design considerations**),
Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit (**refer 3.5 up to 3.5.2 of Text 1**),
Unijunction Transistor: Basic operation and UJT Firing Circuit (**refer 3.6, up to 3.6.4, except 3.6.2**).

**L1, L2**

**Module - 2**

**Phase Controlled Converter:** Control techniques, Single phase half wave and full wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode (**refer Chapter 6 of Text 1 up to 6.4.1 without derivations**).
**Choppers:** Chopper Classification, Basic Chopper operation: step-down, step-up and step-up/down choppers. (**refer Chapter 8 of Text 1 up to 8.3.3**)

**L1, L2, L3**

## Module - 3

**Inverters:** Classification, Single phase Half bridge and full bridge inverters with R and RL load (**refer Chapter 9 of Text 1 up to 9.4.2 without Circuit Analysis**).

**Switched Mode Power Supplies**: Isolated Flyback Converter, Isolated Forward Converter (**only refer to the circuit operations in section 16.3 of Text 1 up to 16.3.2 except 16.3.1.3 and derivations**).

**Principles of Measurement:** Static Characteristics, Error in Measurement, Types of Static Error. (Text 2: 1.2-1.6)
Multirange Ammeters, Multirange voltmeter. (Text 2: 3.2, 4.4 )

**L1, L2, L3**

## Module - 4

**Digital Voltmeter:** Ramp Technique, Dual slope integrating Type DVM, Direct Compensation type and Successive Approximations type DVM (Text 2: 5.1-5.3, 5.5, 5.6)

**Digital Multimeter:** Digital Frequency Meter and Digital Measurement of Time, Function Generator.

**Bridges:** Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance and Inductance Comparison bridge, Wien's bridge.
(Text 2: refer 6.2, 6.3 up to 6.3.2, 6.4 up to 6.4.2, 8.8, 11.2, 11.8-11.10, 11.14).

**L1, L2**

## Module - 5

**Transducers:** Introduction, Electrical Transducer, Resistive Transducer, Resistive position Transducer, Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT.
(Text 2: 13.1-13.3, 13.5, 13.6 up to 13.6.1, 13.7, 13.8, 13.11).
Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer, Analog Weight Scale (Text 2: 14.3.3, 14.4.1, 14.4.3).

**Programmable Logic Controller:** Structure, Operation, Relays and Registers (Text 2: 21.15, 21.15.2, 21.15.3, 21.15.5, 21.15.6).

**L1, L2, L3**

**Course Outcomes:** At the end of the course students should be able to:

1. Build and test circuits using power electronic devices.
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters and SMPS.
3. Analyze instrument characteristics and errors.
4. Describe the principle of operation and develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.
5. Explain the principle, design and analyze the transducers for measuring physical parameters.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897
2. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.


**Reference Books:**


1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
3. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.
4. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN: 9789332556065.

# ELECTRONIC DEVICES AND INSTRUMENTATION LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL37** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This laboratory course enables students to

- Understand the circuit schematic and its working.
- Study the characteristics of different electronic devices.
- Design and test simple electronic circuits as per the specifications using discrete electronic components.
- Familiarize with EDA software which can be used for electronic circuit simulation.

**PART A : Experiments using Discrete components**

1. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).
2. Half wave rectifier and Full wave rectifier with and without filter and measure the ripple factor.
3. Characteristics of Zener diode and design a Simple Zener voltage regulator determine line and load regulation.
4. Characteristics of LDR and Photo diode and turn on an LED using LDR
5. Static characteristics of SCR.
6. SCR Controlled HWR and FWR using RC triggering circuit
7. Conduct an experiment to measure temperature in terms of current/ voltage using a temperature sensor bridge.
8. Measurement of Resistance using Wheatstone and Kelvin's bridge.

**PART-B : Simulation using EDA software**

(EDWinXP, PSpice, MultiSim, Proteus, Circuit Lab or any equivalent tool)

1. Input and Output characteristics of BJT Common emitter configuration and evaluation of parameters.
2. Transfer and drain characteristics of a JFET and MOSFET.
3. UJT triggering circuit for Controlled Full wave Rectifier.
4. Design and simulation of Regulated power supply.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Recognize and demonstrate functioning of semiconductor power devices.
2. Evaluate the characteristics, switching, power conversion and control by semiconductor power devices.
3. Analyze the response and plot the characteristics of transducers such as LDR, Photo diode, etc.
4. Design and test simple electronic circuits for measurement of temperature and resistance.
5. Use circuit simulation software for the implementation and characterization of electronic circuits and devices.

**Conduct of Practical Examination:**

- All laboratory experiments are to be considered for practical examination.
- For examination one question from **PART-A** and one question from **PART-B or** only one question from **PART-A** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

**Text Books**


1. David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual, 5th Edition, 2009, Oxford University Press.
2. Muhammed H Rashid, "Introduction to PSpice using OrCAD for circuits and electronics", 3rd Edition, Prentice Hall, 2003.

# DIGITAL SYSTEM DESIGN LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL38** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3, L4 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course objectives:** This laboratory course enables students to get practical experience in design, realization and verification of

- De Morgan's Theorem, SOP, POS forms
- Full/Parallel Adders, Subtractors and Magnitude Comparator
- Multiplexer using logic gates
- Demultiplexers and Decoders
- Flip-Flops, Shift registers and Counters.

**NOTE:**

1. Use discrete components to test and verify the logic gates.
2. The IC numbers given are suggestive; any equivalent ICs can be used.
3. For experiment No. 11 and 12 any open source or licensed simulation tool may be used.

**Laboratory Experiments:**

1. Verify (i) De Morgan's Theorem for 2 variables.
   (ii) The sum-of product and product-of-sum expressions using universal gates.
2. Design and implement
   (i) Half Adder & Full Adder using a) basic gates b) NAND gates
   (ii) Half subtractor & Full subtractor using a) basic gates b) NAND gates.
3. Design and implement
   (i) 4-bit Parallel Adder/Subtractor using IC 7483.
   (ii) BCD to Excess-3 code conversion and vice-versa.
4. Design and Implementation of
   (i) 1-bit Comparator.
   (ii) 5-bit Magnitude Comparator using IC 7485.
5. Realize
   (i) Adder & Subtractors using IC 74153.
   (ii) 4-variable function using IC74151(8:1MUX).

6. Realize

(i) Adder &Subtractors using IC74139.

(ii) Binary to Gray code conversion & vice-versa (74139)

7. Realize the following flip-flops using NAND Gates.

Master-Slave JK, D & T Flip-Flops.

8. Realize the following shift registers using IC7474/7495

(i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring (vi) Johnson counter

9. Realize

(i) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop

(ii) Mod-N Counter using IC7490 / 7476

(iii) Synchronous counter using IC74192

10. Design Pseudo Random Sequence generator using 7495.

11.Design Serial Adder with Accumulator and Simulate using Simulation tool.

12. Design Binary Multiplier and Simulate using Simulation tool.

**Course Outcomes**: On the completion of this laboratory course, the students will be able to:

1. Design, realize and verify De Morgan's Theorem, SOP, POS forms
2. Demonstrate the truth table of various expressions and combinational circuits using logic gates.
3. Design various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
4. Construct flips-flops, counters and shift registers.
5. Simulate Serial adder and Binary Multiplier.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

# SEMESTER –II / III / IV
# Aadalitha Kannada

| | | |
|---|---|---|
| Course Code, | 18KAK28/39/49, | CIE Marks, 100 |
| Teaching Hours/Week (L:T:P), | (0:2:0) | |
| Credits , 01 | | |

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ. ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಪರಿವಿಡಿ (ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)

ಅಧ್ಯಾಯ – 1 ಕನ್ನಡಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.
ಅಧ್ಯಾಯ – 2 ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ.
ಅಧ್ಯಾಯ – 3 ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.
ಅಧ್ಯಾಯ – 4 ಪತ್ರ ವ್ಯವಹಾರ.
ಅಧ್ಯಾಯ – 5 ಆಡಳಿತ ಪತ್ರಗಳು.
ಅಧ್ಯಾಯ – 6 ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು.
ಅಧ್ಯಾಯ – 7 ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ.
ಅಧ್ಯಾಯ – 8 ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ.
ಅಧ್ಯಾಯ – 9 ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ.
ಅಧ್ಯಾಯ – 10 ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳು:

- ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡದ ಪರಿಚಯವಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳು ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡುತ್ತದೆ.

- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – CIE **(Continuous Internal Evaluation):**

ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

ಪಠ್ಯಪುಸ್ತಕ : ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ **(Kannada for Administration)**

ಸಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

# Vyavaharika Kannada

| | | |
|---|---|---|
| Course Code, | 18KVK28/39/49, | CIE Marks, 100 |
| Teaching Hours/Week (L:T:P), | (0:2:0) | |
| Credits , 01 | | |

**Course Learning Objectives:**

The course will enable the students to understand Kannada and communicate in Kannada language.

**Table of Contents:**

Chapter - 1: Vyavaharika kannada – Parichaya (Introduction to Vyavaharika Kannada).

Chapter - 2: Kannada Aksharamale haagu uchcharane ( Kannada Alpabets and Pronunciation).

Chapter - 3: Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication).

Chapter - 4: Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana).

Chapter - 5: Activities in Kannada.

**Course Outcomes:**

At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ–CIE **(Continuous Internal Evaluation):**

ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

**Textbook** (ಪಠ್ಯಪುಸ್ತಕ): ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ**(Vyavaharika Kannada Text Book)**

ಸಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

# CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)

| | | |
|---|---|---|
| Course Code | : 18CPC39/49 | CIE Marks : 40 |
| Lecture Hours/Week (L:T:P) | : (1:0:0) | SEE Marks : 60 |
| **Credits : 01** | | Exam Hours : 02 |

**Course Learning Objectives:** To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

## Module-1

**Introduction to Indian Constitution:**

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

## Module-2

**Union Executive and State Executive:**

Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370, 371,371J) for some States.

## Module-3

**Elections, Amendments and Emergency Provisions:**

Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7, 9, 10, 12, 42, 44,

61, 73, 74, 75, 86 and 91, 94, 95, 100, 101, 118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.
**Constitutional special provisions:**
Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

**Module-4**

**Professional / Engineering Ethics:**
Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

**Module-5**

**Internet Laws, Cyber Crimes and Cyber Laws:**
Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

**Course Outcomes:** On completion of this course, students will be able to,
1. Describe and analyze the role and salient features of the Indian Constitution
2. Understand the structure and powers of the Union and State Executives.
3. Relate to the procedures and provisions in the electoral process.
4. Develop Engineering and Professional ethics and adopt the responsibilities expected of an Engineer.
5. Identify the cybercrimes and describe the cyber laws for cyber safety measures.

**Question paper pattern for SEE and CIE:**
- The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
- For the award of 40 CIE marks, refer the University regulations 2018.

**Textbook/s**
1. Constitution of India, Professional Ethics and Human Rights, Shubham Singles, Charles E. Haries, and et al, Cengage Learning India, 2018

2. Cyber Security and Cyber Laws, Alfred Basta and et. al., Cengage Learning India, 2018

**Reference Books**

1. Introduction to the Constitution of India, Durga Das Basu, Prentice – Hall, 2008.
2. Engineering Ethics, M. Govindarajan, S. Natarajan, V. S. Senthilkumar, Prentice – Hall, 2004

# ADDITIONAL MATHEMATICS – I

| | | |
|---|---|---|
| Course Code | : 18MATDIP31 | CIE Marks : 40 |
| Lecture Hours/Week (L:T:P) : (2:1:0) | | SEE Marks : 60 |
| **Credits : 0** | | Exam Hours : 03 |

**Course Learning Objectives:**

- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODEs.

## Module-1

**Complex Trigonometry:** Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
**Vector Algebra:** Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

## Module-2

**Differential Calculus:** Review of elementary differential calculus. Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions, problems.
**Partial Differentiation:** Euler's theorem for homogeneous functions of two variables. Total derivatives - differentiation of composite function. Application to Jacobians of order two.

## Module-3

**Vector Differentiation:** Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.

## Module-4

**Integral Calculus:** Review of elementary integral calculus. Statement of reduction formulae for $\sin^n x, \cos^n x, and \sin^m x \times \cos^n x$ and evaluation of these with standard limits-Examples. Double and triple integrals, problems.

## Module-5

**Ordinary differential equations (ODEs):** Introduction-solutions of first order and first degree differential equations: Variable Separable methods, exact and linear differential equations of order one. Application to Newton's law of cooling.

**Course Outcomes:** At the end of the course the student will be able to:

1. Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
2. Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
3. Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
4. Learn techniques of integration including the evaluation of double and triple integrals.
5. Identify and solve first order ordinary differential equations.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Textbook**

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 43rd Edition, 2015

**Reference Books**

1. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 10th Edition, 2015
2. Engineering Mathematics Vol.I, Rohit Khurana, Cengage Learning, 2015

**BE 2018 Scheme Fourth Semester Syllabus EC / TC**
**B. E. Common to all Programmes**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

## SEMESTER - IV

# COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

| | | | |
|---|---|---|---|
| Course Code | : 18MAT41 | CIE Marks | : 40 |
| Lecture Hours/Week (L:T:P) : (2:2:0) | | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (8 Hrs / Module) | | Exam Hours | : 03 |
| **CREDITS : 03** | | | |

**Course Learning Objectives:**

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

### Module-1

**Calculus of complex functions:** Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.
**Construction of analytic functions:** Milne-Thomson method-Problems.

### Module-2

**Conformal transformations:** Introduction. Discussion of transformations: $w = Z^2$, $w = e^z$, $w = z + 1/z\ (z \neq 0)$. Bilinear transformations- Problems.
**Complex integration:** Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

### Module-3

**Probability Distributions:** Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

## Module-4

**Statistical Methods:** Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.

**Curve Fitting:** Curve fitting by the method of least squares- fitting the curves of the form-

$y = ax + b$, $y = ax^b$ and $y = ax^2 + bx + c$

## Module-5

**Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation and covariance.

**Sampling Theory:** Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
2. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
3. Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.

- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Textbooks**


1. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, $10^{th}$ Edition, 2016
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, $44^{th}$ Edition, 2017
3. Engineering Mathematics, Srimanta Pal et. al., Oxford University Press, $3^{rd}$ Edition, 2016


**Reference Books**


1. Advanced Engineering Mathematics, C. Ray Wylie, Louis C. Barrett, McGraw-Hill , $6^{th}$ Edition 1995
2. Introductory Methods of Numerical Analysis, S.S.Sastry, Prentice Hall of India, $4^{th}$ Edition 2010
3. Higher Engineering Mathematics, B. V. Ramana, McGraw-Hill, $11^{th}$ Edition, 2010
4. A Text Book of Engineering Mathematics, N. P. Bali and Manish Goyal, Laxmi Publications, 2014


**Web links and Video Lectures:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

# ANALOG CIRCUITS

| | | |
|---|---|---|
| Course Code | : **18EC42** | CIE Marks : 40 |
| Lecture Hours/Week : 03 + 2 (Tutorial) | | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | | Exam Hours : 03 |
| **CREDITS : 04** | | |

**Course Learning Objectives:** This course will enable students to:

- Explain various BJT parameters, connections and configurations.
- Design and demonstrate the diode circuits and transistor amplifiers.
- Explain various types of FET biasing, and demonstrate the use of FET amplifiers.
- Construct frequency response of FET amplifiers at various frequencies.
- Analyze Power amplifier circuits in different modes of operation.
- Construct Feedback and Oscillator circuits using FET.

### Module -1

**BJT Biasing: Biasing in BJT amplifier circuits**: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.
**Small signal operation and Models**: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid Π model.
**MOSFETs: Biasing in MOS amplifier circuits:** Fixing $V_{GS}$, Fixing $V_G$, Drain to Gate feedback resistor.
**Small signal operation and modeling**: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance.
**[Text 1: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.6), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.6) ]** **L1, L2,L3**

### Module -2

**MOSFET Amplifier configuration:** Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance $R_S$, Source follower.
**MOSFET internal capacitances and High frequency model:** The gate capacitive effect, Junction capacitances, High frequency model.
**Frequency response of the CS amplifier**: The three frequency bands, high frequency response, Low frequency response.

**Oscillators:** FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation)

**[Text 1: 4.7(4.7.1 to 4.7.4, 4.7.6) 4.8(4.8.1, 4.8.2, 4.8.3), 4.9, 12.2.2, 12.3.1, 12.3.2] L1, L2, L3**

**Module -3**

**Feedback Amplifier:** General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis).

**Output Stages and Power Amplifiers:** Introduction, Classification of output stages,, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier.

**[Text 1: 7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 13.1, 13.2, 13.3 (13.3.1, 13.3.2, 13.3.3, 13.4, 13.7)] L1, L2, L3**

**Module -4**

**Op-Amp with Negative Feedback and general applications**

Inverting and Non inverting Amplifiers – Closed Loop voltage gain, Input impedance, Output impedance, Bandwidth with feedback. DC and AC Amplifiers, Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Comparators, Zero Crossing Detector, Schmitt trigger.

**[Text 2: 3.3(3.3.1 to 3.3.6), 3.4(3.4.1 to 3.4.5) 6.2, 6.5, 6.6 (6.6.1), 8.2, 8.3, 8.4] L1, L2, L3**

**Module -5**

**Op-Amp Circuits**: DAC - Weighted resistor and R-2R ladder, ADC-Successive approximation type, Small Signal half wave rectifier, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters.

**555 Timer and its applications:** Monostable and a stable Multivibrators.

**[Text 2: 8.11(8.11.1a, 8.11.1b), 8.11.2a, 8.12.2, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 9.4.1, 9.4.1(a), 9.4.3, 9.4.3(a)] L1, L2, L3**

**Course Outcomes:**At the end of this course students will demonstrate the ability to

1. Understand the characteristics of BJTs and FETs.
2. Design and analyze BJT and FET amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of linear ICs.
5. Design of Linear IC based circuits.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford, 2015. ISBN:978-0-19-808913-1
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition. Pearson Education, 2000. ISBN: 8120320581


**Reference Books:**


1. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0.
2. Fundamentals of Microelectronics, Behzad Razavi, 2nd Edition, John Weily, 2015, ISBN 978-81-265-7135-2
3. J.Millman & C.C. Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5

# CONTROL SYSTEMS

| | | |
|---|---|---|
| Course Code | : **18EC43** | CIE Marks : 40 |
| Lecture Hours/Week : 3 | | SEE Marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hrs/Module) | | Exam Hours: 03 |
| | **CREDITS – 03** | |

**Course Learning Objectives**: This course will enable students to:

- Understand the basic features, configurations and application of control systems.
- Understand various terminologies and definitions for the control systems.
- Learn how to find a mathematical model of electrical, mechanical and electro- mechanical systems.
- Know how to find time response from the transfer function.
- Find the transfer function via Masons' rule.
- Analyze the stability of a system from the transfer function.

**Module – 1**

**Introduction to Control Systems:** Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Electromechanical systems, Analogous Systems.

**L1, L2, L3**

**Module – 2**

**Block diagrams and signal flow graphs:** Transfer functions, Block diagram algebra and Signal Flow graphs.

**L1, L2, L3**

**Module – 3**

**Time Response of feedback control systems:** Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). **L1, L2, L3**

**Module – 4**

**Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion.

Introduction to Root-Locus Techniques, The root locus concepts, Construction of rootloci.

**Frequency domain analysis and stability:** Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.

**L1, L2, L3**

**Module – 5**

Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded)

Introduction to lead, lag and lead- lag compensating networks (excluding design).

**Introduction to State variable analysis:** Concepts of state, state variable and state models for electrical systems, Solution of state equations.

**L1, L2, L3**

**Course Outcomes:** At the end of the course, the students will be able to

1. Develop the mathematical model of mechanical and electrical systems.
2. Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method.
3. Determine the time domain specifications for first and second order systems.
4. Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
5. Determine the s stability of a system in the frequency domain using Nyquist and bode plots.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. J. Nagarath and M. Gopal, "Control Systems Engineering", New Age International(P) Limited, Publishers, Fifth edition- 2005, ISBN: 81 - 224 -2008-7.

**Reference Books:**


1. "Modern Control Engineering", K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002. ISBN 978 - 81 - 203 - 4010 - 7.
2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. "Feedback and Control System," Joseph J Distefano III et. al., Schaum's Outlines, TMH, 2nd Edition 2007.

# ENGINEERING STATISTICS and LINEAR ALGEBRA

| | |
|---|---|
| Course Code : **18EC44** | CIE Marks : 40 |
| Lecture Hours/Week : 03 | SEE Marks : 60 |
| Total Number of Lecture Hours: 40 (8 Hrs / Module) | Exam Hours : 03 |
| **CREDITS – 03** | |

**Course Learning Objectives:** This course will enable students to:

- Understand and Analyze Single and Multiple Random Variables, and their extension to Random Processes.
- Familiarization with the concept of Vector spaces and orthogonality with a qualitative insight into applications in communications.
- Compute the quantitative parameters for functions of single and Multiple Random Variables and Processes.
- Compute the quantitative parameters for Matrices and Linear Transformations.

**Module-1**

**Single Random Variables:** Definition of random variables, cumulative distribution function continuous and discrete random variables; probability mass function, probability density functions and properties; Expectations, Characteristic functions, Functions of single Random Variables, Conditioned Random variables. Application exercises to Some special distributions: Uniform, Exponential, Laplace, Gaussian, Binomial, and Poisson distribution.
**(Chapter 4 Text 1)**, **L1, L2, L3**

**Module -2**

**Multiple Random variables:** Concept, Two variable CDF and PDF, Two Variable expectations (Correlation, orthogonality, Independent), Two variable transformation, Two Gaussian Random variables, Sum of two independent Random Variables, Sum of IID Random Variables – Central limit Theorem and law of large numbers, Conditional joint Probabilities, Application exercises to Chi-square RV, Student-T RV, Cauchy and Rayleigh RVs.
**(Chapter 5 Text 1)**, **L1, L2, L3**

**Module-3**

**Random Processes:** Ensemble, PDF, Independence, Expectations, Stationarity, Correlation Functions (ACF, CCF, Addition, and Multiplication), Ergodic Random Processes, Power Spectral Densities (Wiener Khinchin, Addition and Multiplication of RPs, Cross spectral densities), Linear Systems (output Mean, Cross correlation and Auto correlation of Input and output), Exercises with Noise. **(Chapter 6 Text 1)**, **L1, L2, L3**

**Module -4**

**Vector Spaces:** Vector spaces and Null subspaces, Rank and Row reduced form, Independence, Basis and dimension, Dimensions of the four subspaces, Rank-Nullity Theorem, Linear Transformations

**Orthogonality:** Orthogonal Vectors and Subspaces, Projections and Least squares, Orthogonal Bases and Gram- Schmidt Orthogonalization procedure.

**(Refer Chapters 2 and 3 Text 2)**, **L1, L2, L3**

**Module -5**

**Determinants:** Properties of Determinants, Permutations and Cofactors. **(Refer Chapter 4, Text 2)**

**Eigen values and Eigen vectors:** Review of Eigenvalues and Diagonalization of a Matrix, Special Matrices (Positive Definite, Symmetric) and their properties, Singular Value Decomposition.

**(Refer Chapter 5, Text 2)**, **L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Analyze and evaluate single and multiple random variables.
2. Identify and associate Random Variables and Random Processes in Communication events.
3. Analyze and model the Random events in typical communication events to extract quantitative statistical parameters.
4. Analyze and model typical signal sets in terms of a basis function set of Amplitude, phase and frequency.
5. Demonstrate by way of simulation or emulation the ease of analysis employing basis functions, statistical representation and Eigen values.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. Richard H Williams, "Probability, Statistics and Random Processes for Engineers" Cengage Learning, 1st Edition, 2003, ISBN 13: 978-0-534- 36888-3, ISBN 10: 0-534-36888-3.

2. Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN 97809802327

**Reference Books:**


1. Hwei P. Hsu, "Theory and Problems of Probability, Random Variables, and Random Processes" Schaums Outline Series, McGraw Hill. ISBN 10: 0-07- 030644-3.
2. K. N. HariBhat, K Anitha Sheela, Jayant Ganguly, "Probability Theory and Stochastic Processes for Engineers", Cengage Learning India, 2019

# SIGNALS AND SYSTEMS

| | | |
|---|---|---|
| Course Code | : **18EC45** | CIE Marks : 40 |
| Lecture Hours/Week : 03 | | SEE Marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hours / Module) | | Exam Hours : 03 |
| | **CREDITS – 03** | |

**Course Learning Objectives:** This course will enable students to:

- Understand the mathematical description of continuous and discrete time signals and systems.
- Analyze the signals in time domain using convolution sum and Integral.
- Classify signals into different categories based on their properties.
- Analyze Linear Time Invariant (LTI) systems in time and transform domains.

### Module-1

**Introduction and Classification of signals:** Definition of signal and systems, communication and control system as examples Classification of signals.

**Basic Operations on signals**: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal.

**Elementary signals/Functions**: Exponential, sinusoidal, step,impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals.,

**L1, L2, L3**

### Module -2

**System Classification and properties:** Linear-nonlinear, Time variant -invariant, causal-noncausal, static-dynamic, stable-unstable, invertible.

**Time domain representation of LTI System:** Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.

**L1, L2, L3**

### Module-3

**LTI system Properties in terms of impulse response:** System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution, and step response.

**Fourier Representation of Periodic Signals**: CTFS properties and basic problems.

**L1, L2, L3**

### Module -4

**Fourier Representation of aperiodic Signals**: Introduction to Fourier Transform & DTFT, Definition and basic problems.

**Properties of Fourier Transform**: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform.

**L1, L2, L3**

## Module -5

**The Z-Transforms**: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems. **L1, L2, L3**

**Course Outcomes:** At the end of the course, students will be able to:

1. Analyze the different types of signals and systems.
2. Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
3. Evaluate the convolution sum and integral.
4. Represent continuous and discrete signals & systems in frequency domain using Fourier representations.
5. Analyze discrete time signals and systems using Z-transforms.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.

**Reference Books:**

1. **Michael Roberts,** "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S Willsky and S Hamid Nawab,** "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H.P Hsu, R. Ranjan,** "Signals and Systems", Schaum's outlines, TMH, 2006.
4. **B. P. Lathi,** "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga,** "Signals and Systems", Pearson/ Sanguine.

# MICROCONTROLLER

| | | |
|---|---|---|
| Course Code | : **18EC46** | CIE Marks : 40 |
| Lecture Hours/Week : 03 | | SEE Marks : 60 |
| Total Number of Lecture Hours : 40 (8 Hours / Module) | | Exam Hours:03 |
| **CREDITS – 03** | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- Familiarize the basic architecture of 8051 microcontroller.
- Program 8051microprocessor using Assembly Level Language and C.
- Understand the interrupt system of 8051 and the use of interrupts.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
- Interface 8051 to external memory and I/O devices using its I/O ports.

## Module-1

**8051 Microcontroller:** Microprocessor vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

**L1, L2**

## Module -2

**8051 Instruction Set:** Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.

**L1, L2**

## Module-3

**8051 Stack, I/O Port Interfacing and Programming:** 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops.

Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. **L1, L2, L3**

## Module -4

**8051 Timers and Serial Port:** 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode-2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS-232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. **L1, L2, L3**

## Module -5

**8051 Interrupts and Interfacing Applications:** 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming.

**L1, L2, L3**

**Course outcomes:** At the end of the course, students will be able to:

1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2. Write 8051 Assembly level programs using 8051 instruction set.
3. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.
4. Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.
5. Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/ Cengage Learning.

**Reference Books:**


1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

# MICROCONTROLLER LABORATORY

| | | |
|---|---|---|
| Laboratory Code : **18ECL47** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week : 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Levels : L1, L2, L3 | | Exam Hours : 03 |
| **CREDITS 02** | | |

**Course Learning Objectives:** This laboratory course enables students to

- Understand the basics of microcontroller and its applications.
- Have in-depth knowledge of 8051 assembly language programming.
- Understand controlling the devices using C programming.
- The concepts of I/O interfacing for developing real time embedded systems.

**Laboratory Experiments**

**I. PROGRAMMING**

1. Data Transfer: Block Move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.
7. Programs to generate delay, Programs using serial port and on-Chip timer/counter.

**II. INTERFACING**

1. Interface a simple toggle switch to 8051 and write an ALP to generate an interrupt which switches on an LED (i) continuously as long as switch is on and (ii) only once for a small time when the switch is turned on.
2. Write a C program to (i) transmit and (ii) to receive a set of characters serially by interfacing 8051 to a terminal.
3. Write ALPs to generate waveforms using ADC interface.
4. Write ALP to interface an LCD display and to display a message on it.
5. Write ALP to interface a Stepper Motor to 8051 to rotate the motor.
6. Write ALP to interface ADC-0804 and convert an analog input connected to it.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Enhance programming skills using Assembly language and C.
2. Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051.
3. Interface different input and output devices to 8051 and control them using Assembly language programs.
4. Interface the serial devices to 8051 and do the serial transfer using C programming.
5. Develop applications based on Microcontroller 8051.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

# ANALOG CIRCUITS LABORATORY

| | | |
|---|---|---|
| Laboratory Code : **18ECL48** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week : 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Levels : L1, L2, L3 | | Exam Hours : 03 |
| **CREDITS 02** | | |

**Course Learning Objectives:** This laboratory course enables students to

- Understand the circuit configurations and connectivity of BJT and FET Amplifiers and Study of frequency response
- Design and test of analog circuits using OPAMPs
- Understand the feedback configurations of transistor and OPAMP circuits
- Use of circuit simulation for the analysis of electronic circuits.

**Laboratory Experiments**

**PART A : Hardware Experiments**

1. Design and setup the Common Source JFET/MOSFET amplifier and plot the frequency response.
2. Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
3. Design and set-up BJT/FET i) Colpitts Oscillator and ii) Crystal Oscillator
4. Design active second order Butterworth low pass and high pass filters.
5. Design Adder, Integrator and Differentiator circuits using Op-Amp
6. Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis.
7. Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
8. Design Monostable and a stable Multivibrator using 555 Timer.

**PART-B : Simulation using EDA software** (EDWinXP, PSpice, MultiSim, Proteus, CircuitLab or any other equivalent tool can be used)

1. RC Phase shift oscillator and Hartley oscillator
2. Narrow Band-pass Filter and Narrow band-reject filter
3. Precision Half and full wave rectifier
4. Monostable and Astable Multivibrator using 555 Timer.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Analyze Frequency response of JFET/MOSFET amplifier.
2. Design BJT/FETs amplifier with and without feedback and evaluate their performance characteristics.
3. Apply the knowledge gained in the design of BJT/FET circuits in Oscillators.
4. Design analog circuits using OPAMPs for different applications.
5. Simulate and analyze analog circuits that uses ICs for different electronic applications.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

**Reference Books:**

1. David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual, 5th Edition, 2009, Oxford University Press.

## ADDITIONAL MATHEMATICS – II

| | | | |
|---|---|---|---|
| Course Code | : **18MATDIP41** | CIE Marks | : 40 |
| Lecture Hours/Week (L:T:P), | : (2:1:0) | SEE Marks | : 60 |
| Credits | : 0 | Exam Hours | : 03 |

**Course Learning Objectives:**

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

### Module-1

**Linear Algebra:** Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

### Module-2

**Numerical Methods:** Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)- problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one third rule and Weddle's rule (without proof) Problems.

### Module-3

**Higher order ODEs:** Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.*[Particular Integral restricted to R(x)=* $e^{ax}$, $\sin ax$ /$\cos ax$ *for* $f(D)y = R(x)$. ]

### Module-4

**Partial Differential Equations (PDEs):-** Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

### Module-5

**Probability:** Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem, problems.

**Course Outcomes:** At the end of the course the student will be able to:

1. Solve systems of linear equations using matrix algebra.
2. Apply the knowledge of numerical methods in modelling and solving engineering problems.
3. Make use of analytical methods to solve higher order differential equations.
4. Classify partial differential equations and solve them by exact methods.
5. Apply elementary probability theory and solve related problems.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbook**

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 43rd Edition, 2015

**Reference Books**

1. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 10th Edition, 2015
2. Engineering Mathematics, N. P. Bali and Manish Goyal, Laxmi Publishers, 7th Edition, 2007
3. Engineering Mathematics, Vol. I, Rohit Khurana, Cengage Learning, 1st Edition, 2015

## SEMESTER – V

# TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP

| | | |
|---|---|---|
| Course Code | : **18ES51** | CIE Marks : 40 |
| Lecture Hours/Week | : 03 | SEE Marks : 60 |
| Total Number of Lecture Hours : 40 (08 Hours / Module) | | Exam Hours : 03 |
| **CREDITS 03** | | |

**Course Learning Objectives:** This course will enable students to:

- Understand basic skills of Management
- Understand the need for Entrepreneurs and their skills
- Identify the Management functions and Social responsibilities
- Understand the Ideation Process, creation of Business Model, Feasibility Study and sources of funding

### Module-1

**Management:** Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession **(Selected topics of Chapter 1, Text 1).**

**Planning:** Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making (**Selected topics from Chapters 4 & 5, Text 1). L1,L2**

### Module-2

**Organizing and Staffing: Organization**-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees–Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; **Staffing**-Need and Importance**,** Recruitment and Selection Process **(Selected topics from Chapters 7, 8 & 11,Text 1).**

**Directing and Controlling:** Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership;

Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process
**(Selected topics from Chapters 15 to 18 and 9, Text 1).** **L1,L2**

### Module-3

**Social Responsibilities of Business:** Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance **(Selected topics from Chapter 3, Text 1).**
**Entrepreneurship**: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship **(Selected topics from Chapter 2, Text 2).** **L1,L2**

### Module-4

**Family Business:** Role and Importance of Family Business, Contributions of Family Business in India, Stages of Development of a Family Business, Characteristics of a Family-owned Business in India, Various types of family businesses **(Selected topics from Chapter 4,(Page 71-75) Text 2).**
**Idea Generation and Feasibility Analysis-** Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities.**(Selected topics from Chapter 6(Page No. 111-117) & Chapter 7(Page No. 140-142), Text 2)**
**L1,L2**

### Module-5

**Business model** – Meaning, designing, analyzing and improvising; Business Plan – Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails? **(Selected topics from Chapter 8 (Page No 159-164, Text 2)**
**Financing and How to start a Business?** Financial opportunity identification; Banking sources; Nonbanking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business; Pre launch, Launch and Post launch requirements; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise**(Selected topics from Chapter 7(Page No 147-149), Chapter 5(Page No 93-99) & Chapter 8(Page No. 166-172) Text 2)**
**Project Design and Network Analysis:** Introduction, Importance of Network

Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.

**(Selected topics from Chapters 20, Text 3).** **L1,L2,L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Understand the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business
2. Identify the various organizations' architecture
3. Describe the functions of Managers, Entrepreneurs and their social responsibilities
4. Understand the components in developing a business plan
5. Recognize the various sources of funding and institutions supporting entrepreneurs

**Text Books:**

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.
4. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "Entrepreneurship", 8th Edition, Tata Mc-Graw Hill Publishing Co.Ltd.- New Delhi, 2012

**Reference Book:**

1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

# DIGITAL SIGNAL PROCESSING

| | | |
|---|---|---|
| Course Code : **18EC52** | | CIE Marks : 40 |
| Lecture Hours/Week : 03 + 2 (Tutorial) | | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | | Exam Hours : 03 |
| | **CREDITS : 04** | |

**Course Learning Objectives:** This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
- Understand the architecture and working of DSP processor

**Module-1**

**Discrete Fourier Transforms (DFT):** Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties.

**[Text 1]**, **L1,L2,L3**

**Module-2**

**Linear filtering methods based on the DFT**: Use of DFT in Linear Filtering, Filtering of Long data Sequences.

**Fast-Fourier-Transform (FFT) algorithms:** Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms.

**[Text 1]**, **L1,L2, L3**

**Module-3**

**Design of FIR Filters:** Characteristics of practical frequency –selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Design of FIR filters using frequency sampling method. Structure for FIR Systems: Direct form, Cascade form and Lattice structures.

**[Text1]**, **L1, L2, L3**

## Module-4

**IIR Filter Design:** Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II.

**[Text 2],** **L1,L2,L3**

## Module-5

**Digital Signal Processors:** DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, Floating point processors, FIR and IIR filter implementations in Fixed point systems**.**

**[Text 2]**, **L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Determine response of LTI systems using time domain and DFT techniques.
2. Compute DFT of real and complex discrete time signals.
3. Compute DFT using FFT algorithms and linear filtering approach.
4. Design and realize FIR and IIR digital filters.
5. Understand the DSP processor architecture.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60

**Text Book:**


1. Proakis & Manolakis, "Digital Signal Processing – Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, "Digital Signal processing – Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893.

**Reference Books:**


1. Sanjit K Mitra, “Digital Signal Processing, A Computer Based Approach”, 4th Edition, McGraw Hill Education, 2013,
2. Oppenheim & Schaffer, “Discrete Time Signal Processing” , PHI, 2003.
3. D.Ganesh Rao and Vineeth P Gejji, “Digital Signal Processing” Cengage India Private Limited, 2017, ISBN: 9386858231

# PRINCIPLES OF COMMUNICATION SYSTEMS

| | | |
|---|---|---|
| Course Code | : **18EC53** | CIE Marks : 40 |
| Lecture Hours/Week : 03 + 2 (Tutorial) | | SEE marks : 60 |
| Total Number of Lecture Hours : 50 (10 Hrs / Module) | | Exam Hours : 03 |
| **CREDITS : 04** | | |

**Course Learning Objectives:** This course will enable students to

- Understand and analyse concepts of Analog Modulation schemes viz; AM, FM, Low pass sampling and Quantization as a random process.
- Understand and analyse concepts digitization of signals viz; sampling, quantizing and encoding.
- Evolve the concept of SNR in the presence of channel induced noise and study Demodulation of analog modulated signals.
- Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.

### Module-1

**AMPLITUDE MODULATION:** Introduction, Amplitude Modulation: Time & Frequency Domain description, Switching modulator, Envelop detector. **(3.1 – 3.2 in Text)**

**DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION:** Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **(3.3 – 3.4 in Text)**

**SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION:** SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing,Theme Example: VSB Transmission of Analog and Digital Television. **(3.5 – 3.8 in Text)**

**L1, L2, L3**

### Module-2

**ANGLE MODULATION**: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver **(4.1 – 4.6 of Text)**

**L1, L2, L3**

**Module-3**

*[Review of Mean, Correlation and Covariance functions of Random Processes.* ***(No questions to be set on these topics)]***

**NOISE** - Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth **(5.10 in Text)**

**NOISE IN ANALOG MODULATION:** Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM **(6.1 – 6.6 in Text)**

**L1,L2,L3**

**Module-4**

**SAMPLING AND QUANTIZATION**: Introduction, Why Digitize Analog Sources?, The Low pass Sampling process Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.**(7.1 – 7.7 in Text)**

**L1,L2,L3**

**Module-5**

**SAMPLING AND QUANTIZATION (Contd)**: The Quantization Random Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation **(7.8 – 7.10 in Text)**,

Application examples - (a) Video + MPEG **(7.11 in Text)** and (b) Vocoders **(refer Section 6.8 of Reference Book 1)**.

**L1,L2,L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Analyze and compute performance of AM and FM modulation in the presence of noise at the receiver.
2. Analyze and compute performance of digital formatting processes with quantization noise.
3. Multiplex digitally formatted signals at Transmitter.
4. Demultiplex the signals and reconstruct digitally formatted signals at the receiver.
5. Design /Demonstrate the use of digital formatting in Multiplexers, Vocoders and Video transmission.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.

- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. "Communication Systems", Simon Haykin & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

**Reference Books:**

1. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press, 4th edition.
2. An Introduction to Analog and Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.
3. Principles of Communication Systems, H.Taub & D.L.Schilling, TMH, 2011.
4. Communication Systems, Harold P.E, Samy A. Mahmoud, Lee Elliott Stern, Pearson Edition, 2004.

# INFORMATION THEORY and CODING

| | | | |
|---|---|---|---|
| Course Code | : **18EC54** | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (8 Hrs / Module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to

- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithms.
- Model discrete & continuous communication channels.
- Study various error control coding algorithms.

### Module-1

**Information Theory:** Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Markoff Sources

**(Section 4.1, 4.2 of Text 1)** **L1, L2,L3**

### Module-2

**Source Coding**: Encoding of the Source Output, Shannon's Encoding Algorithm**(Sections 4.3, 4.3.1 of Text 1),** Shannon Fano Encoding Algorithm **(Section 2.15 of Reference Book 4)**

Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI, Huffman codes **(Section 2.2 of Text 2)**

**L1, L2, L3**

### Module-3

**Information Channels:** Communication Channels, Discrete Communication channels Channel Matrix, Joint probabilty Matrix, Binary Symmetric Channel, System Entropies. **(Section 4.4, 4.5, 4.51,4.5.2 of Text 1)**

Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, **(Section 2.5, 2.6 of Text 2)**

Binary Erasure Channel, Muroga's Theorem **(Section 2.27, 2.28 of Reference Book 4)**

**L1, L2, L3**

## Module-4

**Error Control Coding**:
Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.

**Binary Cyclic Codes:** Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction **(Sections 9.1, 9.2,9.3,9.3.1,9.3.2,9.3.3 of Text 1)** ,

**L1, L2, L3**

## Module-5

**Convolution Codes**: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) **(Section 8.5 – Articles 1, 2 and 3, 8.6- Article 1 of Text 2),**

**L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
2. Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
3. Model the continuous and discrete communication channels using input, output and joint probabilities
4. Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
5. Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. Digital and Analog Communication Systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

**Reference Books:**

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Principles of Digital Communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering
3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. Information Theory and Coding, HariBhat, Ganesh Rao, Cengage, 2017.
5. Error Correction Coding, Todd K Moon,Wiley Std. Edition, 2006

# ELECTROMAGNETIC WAVES

| | | | |
|---|---|---|---|
| Course Code | : **18EC55** | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (8 Hrs / Module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

**Module-1**

Revision of Vector Calculus – **(Text 1: Chapter 1)**

**Coulomb's Law, Electric Field Intensity and Flux density**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**

**L1, L2, L3**

**Module -2**

**Gauss's law and Divergence**: Gauss law, Application of Gauss law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator $\nabla$ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**

**Energy, Potential and Conductors**: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).** Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**

**L1, L2, L3**

## Module-3

**Poisson's and Laplace's Equations**: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)**

**Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. (**Text: Chapter 8.1 to 8.6)**

**L1, L2, L3**

## Module -4

**Magnetic Forces**: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).**

**Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7).**

Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**

**L1, L2, L3**

## Module -5

**Maxwell's equations** Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)**

**Uniform Plane Wave**: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media ($\gamma$, $\alpha$, $\beta$, $\eta$) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**

**L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.

3. Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
5. Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**


1. W.H. Hayt and J.A. Buck, —Engineering Electromagnetics, 8th Edition, Tata McGraw-Hill, 2014, ISBN-978-93-392-0327-6.


**Reference Books:**


1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balmain, PHI, 2nd Edn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. Fundamentals of Electromagnetics for Engineering - N. Narayana Rao, Pearson.

# Verilog HDL

| | | | |
|---|---|---|---|
| Course Code | : **18EC56** | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/Module) | Exam Hours | : 03 |
| | CREDITS– 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand Verilog Tasks, Functions and Directives.
- Understand timing and delay Simulation.
- Understand the concept of logic synthesis and its impact in verification

**Module 1**

**Overview of Digital Design with Verilog HDL:** Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs.
**Hierarchical Modeling Concepts:** Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. **L1,L2,L3**

**Module 2**

**Basic Concepts:** Lexical conventions, data types, system tasks, compiler directives.
**Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing **L1,L2,L3**

**Module 3**

**Gate-Level Modeling:** Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.
**Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types. **L1,L2,L3**

**Module 4**

**Behavioral Modeling:** Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks.
**Tasks and Functions:** Differences between tasks and functions, declaration, invocation, automatic tasks and functions. **L1,L2,L3**

**Module 5**

**Useful Modeling Techniques:** Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks.

**Logic Synthesis with Verilog:** Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow, Verification of Gate-Level Netlist**. (Chapter 14 till 14.5 of Text).** **L1,L2,L3**

**Course Outcomes:** At the end of this course, students will be able to

1. Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
2. Design and verify the functionality of digital circuit/system using test benches.
3. Identify the suitable Abstraction level for a particular digital design.
4. Write the programs more effectively using Verilog tasks, functions and directives.
5. Perform timing and delay Simulation and Interpret the various constructs in logic synthesis.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book**:

1. Samir Palnitkar, "**Verilog HDL: A Guide to Digital Design and Synthesis"**, Pearson Education, Second Edition.

**Reference Books:**

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

# DIGITAL SIGNAL PROCESSING LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL57** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

**Laboratory Experiments**

**Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:**

1. Verification of sampling theorem (use interpolation function).

2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.

3. Auto and cross correlation of two sequences and verification of their properties

4. Solving a given difference equation.

5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).

6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computation of square pulse and Sinc function etc.

7. Design and implementation of Low pass and High pass FIR filter to meet the desired specifications (using different window techniques) and test the filter with an audio file. Plot the spectrum of audio signal before and after filtering.

8. Design and implementation of a digital IIR filter (Low pass and High pass) to meet given specifications and test with an audio file. Plot the spectrum of audio signal before and after filtering.

**Following Experiments to be done using DSP kit**

9. Obtain the Linear convolution of two sequences.
10. Compute Circular convolution of two sequences.
11. Compute the N-point DFT of a given sequence.
12. Determine the Impulse response of first order and second order system.
13. Generation of sine wave and standard test signals

**Course Outcomes:**

On the completion of this laboratory course, the students will be able to:

1. Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
2. Model the discrete time signals and systems and verify its properties and results.
3. Implement discrete computations using DSP processor and verify the results.
4. Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.
5. Write programs using Matlab / Scilab/Octave to illustrate DSP concepts.

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

**Reference Books:**

1. Vinay K Ingle, John G Proakis, Digital Signal Processing using MATLAB, Fourth Edition, Cengage India Private Limited, 2017.

# HDL LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL58** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to:
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

**Note:** Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

**PART A**

1. Write Verilog program for the following combinational design along with test bench to verify the design:
   a. 2 to 4 decoder realization using NAND gates only (structural model)
   b. 8 to 3 encoder with priority and without priority (behavioural model)
   c. 8 to 1 multiplexer using case statement and if statements
   d. 4-bit binary to gray converter using 1-bit gray to binary converter 1-bit adder and subtractor
2. Model in Verilog for a full adder and add functionality to perform logical operations of XOR, XNOR, AND and OR gates. Write test bench with appropriate input patterns to verify the modeled behaviour.
3. Verilog 32-bit ALU shown in figure below and verify the functionality of ALU by selecting appropriate test patterns. The functionality of the ALU is presented in Table 1.
   a. Write test bench to verify the functionality of the ALU considering all possible input patterns
   b. The enable signal will set the output to required functions if enabled, if disabled all the outputs are set to tri-state
   c. The acknowledge signal is set high after every operation is complete

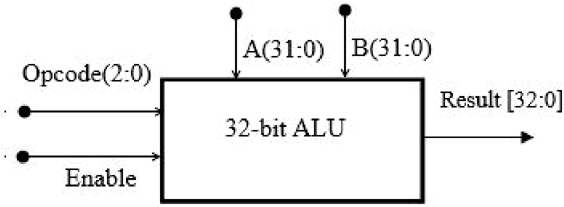


Figure 1 ALU top level block diagram

Table 1 ALU Functions

| Opcode (2:0) | ALU Operation | Remarks | |
|---|---|---|---|
| 000 | A + B | Addition of two numbers | Both A and B are in two's complement format |
| 001 | A – B | Subtraction of two numbers | |
| 010 | A + 1 | Increment Accumulator by 1 | A is in two's complement format |
| 011 | A - 1 | Decrement accumulator by 1 | |
| 100 | A | True | Inputs can be in any format |
| 101 | A Complement | Complement | |
| 110 | A OR B | Logical OR | |
| 111 | A AND B | Logical AND | |

4. Write Verilog code for SR, D and JK and verify the flip flop.
5. Write Verilog code for 4-bit BCD synchronous counter.
6. Write Verilog code for counter with given input clock and check whether it works as clock divider performing division of clock by 2, 4, 8 and 16. Verify the functionality of the code.

## PART-B

**Interfacing and Debugging** (EDWinXP, PSpice, MultiSim, Proteus, CircuitLab or any other equivalent tool can be used)

1. Write a Verilog code to design a clock divider circuit that generates 1/2, 1/3rd and 1/4th clock from a given input clock. Port the design to FPGA and validate the functionality through oscilloscope.
2. Interface a DC motor to FPGA and write Verilog code to change its speed and direction.
3. Interface a Stepper motor to FPGA and write Verilog code to control the Stepper motor rotation which in turn may control a Robotic Arm. External switches to be used for different controls like rotate the Stepper motor (i) +N steps if Switch no.1 of a Dip switch is closed (ii) +N/2 steps if Switch no. 2 of a Dip switch is closed (iii) –N steps if Switch no. 3 of a Dip switch is closed etc.

4. Interface a DAC to FPGA and write Verilog code to generate Sine wave of frequency F KHz (eg. 200 KHz) frequency. Modify the code to down sample the frequency to F/2 KHz. Display the Original and Down sampled signals by connecting them to an oscilloscope.

5. Write Verilog code using FSM to simulate elevator operation.

6. Write Verilog code to convert an analog input of a sensor to digital form and to display the same on a suitable display like set of simple LEDs, 7-segment display digits or LCD display.

**Course Outcomes:** At the end of this course, students will be able to:

1. Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
2. Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
3. Use FPGA/CPLD kits for down loading Verilog codes and check output.
4. Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
5. Interface the hardware to the programmable chips and obtain the required output

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

# ENVIRONMENTAL STUDIES

| | | | |
|---|---|---|---|
| Course Code | : 18CIV59 | CIE Marks | : 40 |
| Lecture Hours / Week (L:T:P) | : (1:0:0) | SEE Marks | : 60 |
| Credits | : 01 | Exam Hours | : 02 |

**Module - 1**

**Ecosystems** (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.

**Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

**Module - 2**

**Advances in Energy Systems** (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.

**Natural Resource Management** (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

**Module - 3**

**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

**Module - 4**

**Global Environmental Concerns**(Concept, policies and case-studies):Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

**Module - 5**

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
**Field work:** Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

**Course outcomes:** At the end of the course, students will be able to:

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
4. Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
5. Relate to the latest Developments in Environmental Pollution Mitigation Tools.

**Question paper pattern:**

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

**Textbook/s**

1. Environmental Studies, Benny Joseph, Tata McGraw – Hill., 2nd Edition, 2012
2. Environmental Studies, S M Prakash, Pristine Publishing House, Mangalore, 3rd Edition, 2018
3. Environmental Studies – From Crisis to Cure, R Rajagopalan, Oxford Publisher, 2005

**Reference Books**

1. Principles of Environmental Science and Engineering, Raman Sivakumar, Cengage learning, Singapur. 2nd Edition, 2005
2. Environmental Science – working with the Earth, G.Tyler Miller Jr., Thomson Brooks /Cole, 11th Edition, 2006
3. Text Book of Environmental and Ecology, Pratiba Sing, Anoop Singh & Piyush Malaviya, Acme Learning Pvt. Ltd. New Delhi, 1st Edition

# B. E. 2018 Scheme Sixth Semester Syllabus (EC)

**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

## SEMESTER – VI

# DIGITAL COMMUNICATION

| | | |
|---|---|---|
| Course Code | : 18EC61 | CIE Marks : 40 |
| Lecture Hours/Week | : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : | 50 (10 Hrs / Module) | Exam Hours : 03 |
| | **CREDITS : 04** | |

**Course Learning Objectives:** This course will enable students to:

- Understand the mathematical representation of signal, symbol, and noise.
- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate channel induced impediments in corrupted channel conditions.

### Module-1

**Bandpass Signal to Equivalent Low pass**: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems **(Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).**

**Line codes:** Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities **(Text 1: Ch 6.10).**
Overview of HDB3, B3ZS, B6ZS **(Ref. 1: 7.2)**

**L1,L2,L3**

### Module-2

**Signaling over AWGN Channels**- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver **(Text 1: 7.1, 7.2, 7.3, 7.4).**

**L1,L2,L3**

### Module – 3

**Digital Modulation Techniques**: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM **(Relevant topics in Text 1 of 7.6, 7.7).**

Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability **(Relevant topics in Text 1 of 7.8).**
Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) **(Text 1: 7.11, 7.12. 7.13).**

**L1,L2,L3**

**Module-4**

**Communication through Band Limited Channels**: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detection of data with controlled ISI **(Text 2: 9.1, 9.2, 9.3.1, 9.3.2).**
Channel Equalization: Linear Equalizers (ZFE, MMSE), **(Text 2: 9.4.2).**

**L1,L2,L3**

**Module-5**

**Principles of Spread Spectrum:** Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 **(Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).**

**L1,L2,L3**

**Course Outcomes:** At the end of the course, the students will be able to:

1. Associate and apply the concepts of Bandpass sampling to well specified signals and channels.
2. Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels.
3. Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.

4. Demonstrate that bandpass signals subjected to corruption and distortion in a bandlimited channel can be processed at the receiver to meet specified performance criteria.
5. Understand the principles of spread spectrum communications.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

**Reference Books:**

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. Bernard Sklar and Ray, "Digital Communications - Fundamentals and Applications", Pearson Education, Third Edition, 2014, ISBN: 978-81-317-2092-9.

# EMBEDDED SYSTEMS

| | | |
|---|---|---|
| Course Code | : 18EC62 | CIE Marks : 40 |
| Lecture Hours/Week | : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : | 50 (10 Hrs / Module) | Exam Hours : 03 |
| **CREDITS : 04** | | |

**Course Learning Objectives:** This course will enable students to:

- Explain the architectural features and instructions of 32 bit microcontroller -ARM Cortex M3.
- Develop Programs using the various instructions of ARM Cortex M3 and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

**Module 1**

**ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence **(Text 1: Ch-1, 2, 3)**

**L1,L2**

**Module 2**

**ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming **(Text 1: Ch-4, Ch-10.1 to 10.6)**

**L1,L2,L3**

**Module 3**

**Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Princeton, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)

**(Text 2: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only)**.

**L1, L2**

**Module 4**

**Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). **Text 2: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)**

**L1,L2,L3**

**Module 5**

**RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques **(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch-12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)**

**L1,L2,L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
2. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
3. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
4. Develop the hardware software co-design and firmware design approaches.
5. Explain the need of real time operating system for embedded system applications.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.


**Reference Books:**


1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd Ed. Man Press LLC ©2015 ISBN: 0982692633 9780982692639.
3. K.V. K. K Prasad, Embedded Real Time Systems, Dreamtech publications, 2003.
4. Rajkamal, Embedded Systems, 2nd Edition, McGraw hill Publications, 2010.

# MICROWAVE and ANTENNAS

| | | |
|---|---|---|
| Course Code | : **18EC63** | CIE Marks : 40 |
| Lecture Hours/Week | : 03 + 2 (Tutorial) | SEE marks : 60 |
| Total Number of Lecture Hours : | 50 (10 Hrs / Module) | Exam Hours : 03 |
| | **CREDITS : 04** | |

**Course Learning Objectives:** This course will enable students to:

- Describe the microwave properties and its transmission media
- Describe microwave devices for several applications
- Understand the basics of antenna theory
- Select antennas for specific applications

## Module 1

**Microwave Tubes:** Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). **(Text 1: 9.1, 9.2.1)**

**Microwave Transmission Lines:** Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching.
**(Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching**)
**L1,L2**

## Module 2

**Microwave Network theory:** Introduction**,** Symmetrical Z and Y-Parameters for reciprocal Networks, S matrix representation of Multi-Port Networks. **(Text1: 6.1, 6.2, 6.3)**

**Microwave Passive Devices:** Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees.
**(Text 1: 6.4.2,6.4.14, 6.4.15, 6.4.16)** **L1,L2**

## Module 3

**Strip Lines:** Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines**. (Text 2: 11.1, 11.2, 11.3, 11.4)**

**Antenna Basics**: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Radio Communication Link, Antenna Field Zones. **(Text 3: 2.1 - 2.7, 2.9 – 2.11, 2.13)** **L1,L2,L3**

## Module 4

**Point Sources and Arrays**: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Arrays of two isotropic point sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.
**(Text 3: 5.1 – 5.6, 5.9, 5.13)**

**Electric Dipoles:** Introduction, Short Electric Dipole, Fields of a Short Dipole, Radiation Resistance of a Short Electric Dipole, Thin Linear Antenna (Field Analyses)
**(Text 3: 6.1 - 6.5)**

**L1,L2,L3,L4**

## Module 5

**Loop and Horn Antenna:** Introduction, Small loop, The Loop Antenna General Case, The Loop Antenna as a special case, Radiation resistance of loops, Directivity of Circular Loop Antennas with uniform current, Horn antennas Rectangular Horn Antennas.
**(Text 3: 7.1, 7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20)**

**Antenna Types**: The Helix geometry, Helix modes, Practical Design considerations for the mono-filar axial mode Helical Antenna, Yagi-Uda array, Parabolic reflector
**(Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)**

**L1,L2,L3**

**Course outcomes:** At the end of the course students will be able to:

1. Describe the use and advantages of microwave transmission
2. Analyze various parameters related to microwave transmission lines and waveguides
3. Identify microwave devices for several applications
4. Analyze various antenna parameters necessary for building a RF system
5. Recommend various antenna configurations according to the applications.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. **Microwave Engineering** – Annapurna Das, Sisir K Das, TMH, Publication, $2^{nd}$, 2010.
2. **Microwave Devices and circuits**- Samuel Y Liao, Pearson Education
3. **Antennas and Wave Propagation**- John D. Krauss, Ronald J Marhefka, Ahmad S Khan, $4^{th}$ Edition, McGraw Hill Education, 2013

**Reference Books:**

1. **Microwave Engineering** - David M Pozar, John Wiley India Pvt. Ltd., $3^{rd}$ Edn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, $2^{nd}$ Edn, 2015
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007

# OPERATING SYSTEM

| | | | |
|---|---|---|---|
| Course Code | : 18EC641 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management.
- Describe the structure and organization of the file system
- Understand interprocess communication and deadlock situations.

**Module-1**

**Introduction to Operating Systems**

OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems

**(Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).**

**L1,L2**

**Module-2**

**Process Management:** OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux

**(Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2 , Selected scheduling topics from 4.2 and 4.3 , 4.6, 4.7 of Text).**

**L1,L2,L3**

**Module – 3**

**Memory Management:** Contiguous Memory allocation, Non-Contiguos Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux

**(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7,6.8 of Text).**

**L1,L2,L3**

## Module-4

**File Systems:** File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access
**(Topics from Sections 7.1 to 7.8 of Text).** **L1,L2**

## Module-5

**Message Passing and Deadlocks**: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention
**(Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text).** **L1,L2**

**Course Outcomes:** At the end of the course, the students will be able to:
1. Explain the goals, structure, operation and types of operating systems.
2. Apply scheduling techniques to find performance factors.
3. Explain organization of file systems and IOCS.
4. Apply suitable techniques for contiguous and non-contiguous memory allocation.
5. Describe message passing, deadlock detection and prevention methods.

**Question paper pattern:**
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

Operating Systems – A Concept based Approach, by Dhamdhere, TMH, 2nd edition.

**Reference Books:**

1. Operating Systems Concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001.
2. Operating System–Internals and Design System, William Stalling, Pearson Education, 4th ed, 2006.
3. Operating Systems - Design and Implementation, Tanenbaum, TMH, 2001.

# ARITIFICAL NEURAL NETWORKS

| | | | |
|---|---|---|---|
| Course Code | : 18EC642 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the basics of ANN and comparison with Human brain.
- Acquire knowledge on Generalization and function approximation of various ANN architectures.
- Understand reinforcement learning using neural networks
- Acquire knowledge of unsupervised learning using neural networks.

**Module-1**

**Introduction**: Biological Neuron – Artificial Neural Model - Types of activation functions – **Architecture**: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

**Learning:** Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.

**L1, L2**

**Module-2**

**Supervised Learning:** Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Back propagation Learning Algorithm, Practical consideration of BP algorithm.

**L1,L2,L3**

**Module-3**

**Support Vector Machines and Radial Basis Function:** Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

**L1,L2, L3**

**Module-4**

**Attractor Neural Networks**: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

**L1,L2, L3**

**Module-5**

**Self-organization Feature Map:** Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

**L1,L2, L3**

**Course Outcomes:** At the end of the course, students will be able to:

1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2. Understand the concepts and techniques of neural networks through the study of important neural network models.
3. Evaluate whether neural networks are appropriate to a particular application.
4. Apply neural networks to particular application.
5. Analyze the steps needed to improve performance of the selected neural network.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. **Neural Networks A Classroom Approach**– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

**Reference Books:**

1. **Introduction to Artificial Neural Systems-**J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks-**B. Yegnanarayana, PHI, New Delhi 1998.

# DATA STRUCTURES USING C++

| | | | |
|---|---|---|---|
| Course Code | : 18EC643 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to

- Solve the problems using object oriented approach
- Explain fundamentals of data structures and their applications essential for programming/problem solving
- Analyze Linear Data Structures: Stack, Queues, Lists
- Analyze Non Linear Data Structures: Trees
- Assess appropriate data structure during program development/Problem Solving

**Module -1**

**INTRODUCTION: C++** and its features, Data types, Variables, Operators, Expressions, Control structures, classes and Objects, Functions and parameters, function overloading, Recursion, Constructors, Destructors and Operator overloading, Inheritance, Polymorphism, Programming examples.

**L1, L2**

**Module -2**

**ARRAYS AND MATRICES:** Arrays, Matrices, Special matrices, Sparse matrices.
**POINTERS:** Pointers, Dynamic memory allocation
**LINEAR LISTS:** Data objects and structures, Introduction to Linear and Non Linear data structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains.

**L1, L2**

**Module -3**

**STACKS:** The abstract data types, Array Representation, Linked Representation, Applications – Parsing and Evaluation of arithmetic expressions, Parenthesis Matching & Towers of Hanoi.

**L1, L2, L3**

**Module -4**

**QUEUES:** The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement, Priority Queues
HASHING: Dictionaries, Linear representation, Hash table representation.

**L1, L2, L3**

## Module -5

**TREES:** Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. Binary search trees operations and implementation. Heaps, Applications-Heap Sorting

**L1, L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Relate to Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
2. Apply object-oriented approach to solve problems
3. Understand non-Linear data structures trees and their applications
4. Design appropriate data structures for solving computing problems
5. Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

**Text Book:**

1. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

**Reference Books:**

2. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.

# DIGITAL SYSTEM DESIGN USING VERILOG

| | | | |
|---|---|---|---|
| Course Code | : 18EC644 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to

- Understand the concepts of Verilog Language.
- Design the digital systems as an activity in a larger systems design context.
- Study the design and operation of semiconductor memories frequently used in application specific digital system.
- Inspect how effectively ICs are embedded in package and assembled in PCBs for different application.
- Design and diagnosis of processors and I/O controllers used in embedded systems.

**Module -1**

**Introduction and Methodology:**
Digital Systems and Embedded Systems, Real-World Circuits, Models, Design Methodology **(1.1, 1.3 to 1.5 of Text).**
**Combinational Basics:** Combinational Components and Circuits, Verification of Combinational Circuits **(2.3 and 2.4 of Text**).
**Number Basics:** Unsigned integers, Signed Integers, Fixed point Numbers, Floating point Numbers **(3.1.1, 3.2.1, 3.3.1 and 3.4).**
**Sequential Basics**: Sequential Datapaths and Control Clocked Synchronous Timing Methodology
**(4.3 up to 4.3.1, 4.4 up to 4.4.1 of Text).** **L1,L2, L3**

**Module -2**

**Memories:** Concepts, Memory Types, Error Detection and Correction
**(Chap 5 of Text).** **L1,L2, L3**

**Module -3**

**Implementation Fabrics:** Integrated Circuits, Programmable Logic Devices, Packaging and Circuit boards, Interconnection and Signal integrity
**(Chap 6 of Text).** **L1,L2, L3**

**Module -4**

**I/O interfacing:** I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software
**(Chap 8 of Text).** **L1,L2, L3**

**Module -5**

**Design Methodology:** Design flow, Design optimization, Design for test, Nontechnical Issues

**(Chap 10 of Text).** **L1,L2, L3, L4**

**Course outcomes:** After studying this course, students will be able to:

1. Construct the combinational circuits, using discrete gates and programmable logic devices.
2. Describe how arithmetic operations can be performed for each kind of code, and also combinational circuits that implement arithmetic operations.
3. Design a semiconductor memory for specific chip design.
4. Design embedded systems using small microcontrollers, larger CPUs/ DSPs, or hard or soft processor cores.
5. Synthesize different types of I/O controllers that are used in embedded system.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60

.

**Text Book:**


- Peter J. Ashenden, "Digital Design: An Embedded Systems Approach Using VERILOG", Elesvier, 2010.


**Reference Books:**


1. Ming-Bo Lin, "Digital System Designs and Practices: Using Verilog HDL and FPGAs", Wiley, 2008
2. Charles Roth, Lizy K. John, Byeong Kil Lee, "Digital Systems Design Using Verilog", Cengage, 1st Edition.
3. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer, Fifth edition.
4. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.

## NANOELECTRONICS

| | | | |
|---|---|---|---|
| Course Code | : 18EC645 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Enhance basic engineering science and technical knowledge of Nanoelectronics.
- Explain basics of top-down and bottom-up fabrication process, devices and systems.
- Describe technologies involved in modern day electronic devices.
- Know various nanostructures of carbon and the nature of the carbon bond itself.
- Learn the photo physical properties of sensor used in generating a signal.

### Module-1

**Introduction:** Overview of nanoscience and engineering. Development milestones in microfabrication and electronic industry. Moore's law and continued miniaturization, Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometerlength scale, Fabrication methods: Top down processes, Bottom up processes methods for templating the growth of nanomaterials, ordering of nanosystems
**(Text 1).** **L1, L2**

### Module-2

**Characterization:** Classification, Microscopic techniques, Field ion microscopy,scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques **(Text 1).**

**Inorganic semiconductor nanostructures:** overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states
**(Text 1).** **L1, L2**

### Module-3

**Fabrication techniques:** requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, collidal quantum dots, self-assembly techniques.**(Text 1).**

**Physical processes:** modulation doping, quantum hall effect, resonant tunneling, charging effects, ballistic carrier transport, Inter band absorption, intraband absorption, Light emission processes, phonon bottleneck, quantum confined stark effect, nonlinear effects, coherence and dephasing, characterization of semiconductor nanostructures: optical electrical and structural

**(Text 1).** **L1, L2**

**Module-4**

**Carbon Nanostructures:** Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes.

**(Text 2)** **L1, L2**

**Module-5**

**Nanosensors:** Introduction, What is Sensor and Nanosensors?, What makes them Possible?, Order From Chaos, Characterization, Perception, NanosensorsBased On Quantum Size Effects, Electrochemical Sensors, Sensors Based On Physical Properties, Nanobiosensors, Smart dust Sensor for the future. **(Text 3)**

**Applications:** Injection lasers, quantum cascade lasers, single-photon sources, biological tagging, optical memories, coulomb blockade devices, photonic structures, QWIP's, NEMS, MEMS

**(Text 1).** **L1, L2**

**Course Outcomes:** After studying this course, students will be able to:

1. Construct the combinational circuits, using discrete gates and programmable logic devices.
2. Describe how arithmetic operations can be performed for each kind of code, and also combinational circuits that implement arithmetic operations.
3. Design a semiconductor memory for specific chip design.
4. Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores.
5. Synthesize different types of I/O controllers that are used in embedded system.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Edited by Robert Kelsall, Ian Hamley and Mark Geoghegan, "Nanoscale Science and Technology", John Wiley, 2007.
2. Charles P Poole, Jr, Frank J Owens, "Introduction to Nanotechnology", John Wiley, Copyright 2006, Reprint 2011.
3. T Pradeep, "Nano: The essentials-Understanding Nanoscience and Nanotechnology", TMH.


**Reference Book:**


1. Edited by William A Goddard III, Donald W Brenner, Sergey E. Lyshevski and Gerald J Iafrate, "Hand Book of Nanoscience Engineering and Technology", CRC press, 2003.

## PYTHON APPLICATION PROGRAMMING

| | | | |
|---|---|---|---|
| Course Code | : 18EC646 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40(08 Hrs/module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services, Network and Database Programs in Python.

### Module – 1

Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions,

**L1, L2, L3**

### Module – 2

Iteration, Strings, Files,

**L1, L2, L3**

### Module – 3

Lists, Dictionaries, Tuples, Regular Expressions,

**L1, L2, L3**

### Module – 4

Classes and objects, Classes and functions, Classes and methods,

**L1, L2, L3**

### Module – 5

Networked programs, Using Web Services, Using databases and SQL,

**L1, L2, L3**

**Course outcomes:** The students will be able to:

1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

**Question paper pattern:**

- The question paper will have TEN questions.
- There will be TWO questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

**Text Books:**

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016 (Chapters 1 – 13, 15).
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015 (Chapters 15,16,17)

**References:**

1. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13:978-9350232873.
2. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
3. Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017

# SIGNAL PROCESSING

| | | | |
|---|---|---|---|
| Course Code | : 18EC651 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course objective:** This course will enable students to:

- Understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- Ability to represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain
- Understand the properties of analog filters, and have the ability to design Butterworth filters
- Understand and apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time (without loss of information)
- Able to represent the discrete time signal in the frequency domain
- Able to design FIR and IIR filters to meet given specifications

**Module-1**

Signal Definition, Signal Classification, System definition, System classification, for both continuous time and discrete time. Definition of LTI systems

**(Chapter 1)** **L1, L2**

**Module-2**

Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems,

**(Chapter 3)** **L1, L2**

**Module-3**

Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications

**(Chapter 8)** **L1,L2, L3**

**Module-4**

Sampling Theorem- Statement and proof, converting the analog signal to a digital signal. Practical sampling. The Discrete Fourier Transform, Properties of DFT. Comparing the frequency response of analog and digital systems. (FFT not included)

**(Chapter 3, 4)** **L1,L2, L3**

## Module-5

Definition of FIR and IIR filters. Frequency response of ideal digital filters Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, and the frequency sampling technique to meet given specifications Comparing the designed filter with the desired filter frequency response

**(Chapter 8)** **L1,L2,L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Understand and explain continuous time and discrete time signals and systems, in time and frequency domain
2. Apply the concepts of signals and systems to obtain the desired parameter/ representation
3. Analyse the given system and classify the system/arrive at a suitable conclusion
4. Design analog/digital filters to meet given specifications
5. Design and implement *(assignment component)*
   a. the analog filter using components/ suitable simulation tools
   b.the digital filter (FIR/IIR) using suitable simulation tools, and
   c.record the input and output of the filter for the given audio signal

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

- 'Signals and Systems', by Simon Haykin and Barry Van Veen, Wiley.

**References:**

1. 'Theory and Application of Digital Signal Processing', Rabiner and Gold
2. 'Signals and Systems', Schaum's Outline series
3. 'Digital Signal Processing', Schaum's Outline series

# SENSORS and SIGNAL CONDITIONING

| | | | |
|---|---|---|---|
| Course Code | : 18EC652 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Understand various technologies associated in manufacturing of sensors
- Acquire knowledge about types of sensors used in modern digital systems
- Get acquainted about material properties required to make sensors

**Module 1**

**Introduction to sensor based measurement systems:**
General concepts and terminology, sensor classification, primary sensors, material for sensors, microsensor technology, magnetoresistors, light dependent resistors, resistive hygrometers,resistive gas sensors, liquid conductivity sensors
**(Selected topics from ch.1 & 2 of Text)**

**L1, L2**

**Module 2**

**Reactance Variation and Electromagnetic Sensors:** -Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors.
**Signal Conditioning for Reactance Variation Sensors**-Problems and Alternatives, ac Bridges Carrier Amplifiers, Coherent Detection, Specific Signal Conditioners for Capacitive Sensors, Resolver-to-Digital and Digital-to-Resolver Converters. **L1, L2**

**Module 3**

**Self-generating Sensors-**Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors.

**L2, L3**

**Module 4**

**Digital and intelligent sensors-**position encoders, resonant sensors, sensors based on quartz resonators, SAW sensors, Vibrating wire strain gages, vibrating cylinder sensors, Digital flow meters.

**L2, L3**

## Module 5

**Sensors based on semiconductor junctions** -Thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, sensors based on MOSFET transistors, charge- coupled sensors – types of CCD imaging sensors, ultrasonic-based sensors.

**L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Appreciate various types of sensors
2. Describe the manufacturing process of sensors
3. Understand about the material properties required to make sensors
4. Use sensors specific to the end use application
5. Design systems integrated with sensors

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book**:

"Sensors and Signal Conditioning", Ramon PallásAreny, John G. Webster, 2nd edition, John Wiley and Sons, 2000

## ADDITIONAL OPEN ELECTIVES-A OFFERED BY EC/TC BOARD

<table>
<tr><td colspan="4" align="center">B. E. EC/TE<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VI</td></tr>
<tr><td colspan="4" align="center">VIRTUAL INSTRUMENTATION</td></tr>
<tr><td>Course Code</td><td>18EC653</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40(8Hours/Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
</table>

**Course objective:** This course will enable students to:

- Understand the fundamental principles of virtual instrumentation
- Acquire, analyze and present data using LabVIEW

| Module-1 | RBT Level |
|---|---|
| **Graphical System Design**: Introduction, Graphical system design model, Design flow with GSD, Virtual Instrumentation, Virtual instrument and traditional instrument, Hardware and software in virtual instrumentation, Virtual instrumentation for Test, control & design, Graphical system design using LABVIEW, Graphical programming & textual programming. | **L1, L2, L3** |
| **Module-2** | |
| **Introduction to LabVIEW**: Introduction, advantages of LABVIEW software environment, palettes, front panel controls & indicators, Block diagram, Data flow program.<br>**Repetition and Loops**: For loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feed-back nodes, control timing, case structure. | **L1, L2, L3** |
| **Module-3** | |
| **Arrays**: Introduction, arrays in LABVIEW, creating one - dimensional array controls, indicators and constants, creating two dimensional arrays, creating multidimensional arrays, initializing array, deleting, inserting, and replacing elements, rows, columns, and pages with in arrays, arrays functions. | **L1, L2, L3** |
| **Module-4** | |
| **Plotting Data**: Types of waveforms, waveform graphs, waveform charts, XY graphs, Intensity graphs & charts, Digital waveform graphs, 3D graphs, customizing graphs & charts, configuring a graph or chart, Displaying special planners on the XY graph. | **L1,L2, L3** |
| **Module-5** | |
| **File Input/ Output**: File formats, file write &read, generating filenames automatically, **String handling**: string functions, LABVIEW string formats, parsing of strings.<br>**Instrument Control**: Introduction, GPIB communication, Hardware specification, software architecture, Instrument I/O assistant, VISA, Instrument drivers, serial port communications, using other interfaces. | **L1, L2, L3** |

**Course Outcomes:** After studying this course, students will be able to:

1. Recognize the Graphical system design model and develop programs using the modern tools of Graphical programming & textual programming
2. Develop a virtual instrumentation model using the front panel controls & indicators and loops.
3. Analyze, design the various array and matrix operations using LabVIEW functions.
4. Evaluate the various forms of output representations using graphs & charts
5. Demonstrate Instrument Control, GPIB communication and other interfaces

Students have to conduct the following experiments as a part of CIE marks along with other Activities:

1. Build a VI code to indicate the change in temperature using LabVIEW
2. Develop a code in VI to convert 4-bit binary input to gray output using LabVIEW
3. Generate a VI code to display sinusoidal and triangular waveforms using LabVIEW
4. Build a code using LabVIEW to compute the sum of N numbers (use FOR loop)
5. Develop a VI code using LabVIEW to sort the even numbers (use while loop)
6. Using LabVIEW compute the basic operations of a simple calculator using case structure

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. "Virtual Instrumentation using LABVIEW", Jovitha Jerome, PHI, 2010
2. "Virtual Instrumentation using LABVIEW", Sanjay Gupta, Joseph John, TMH, McGraw Hill Second Edition, 2011.

**Reference:**

"Learning with LabView", Robert H Bishop, Prentice Hall, 2009.

## ADDITIONAL OPEN ELECTIVES-A OFFERED BY EC/TC BOARD

<table>
<tr><td colspan="4" align="center">B. E. EC/TE<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VI</td></tr>
<tr><td colspan="4" align="center">MICROCONTROLLERS</td></tr>
<tr><td>Course Code</td><td>18EC654</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40(8Hours/Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
<tr><td colspan="4">Course objective: This course will enable students to:<br>• Learn architecture of 8051.<br>• Learn programming skills using Assembly language and C<br>• Design and interface microcontroller based embedded systems.<br>• Build projects</td></tr>
<tr><td colspan="3" align="center">Module-1</td><td align="center">RBT Level</td></tr>
<tr><td colspan="3">Microprocessors and Microcontroller: Introduction, Microprocessors and Microcontrollers, Microcontroller Survey. (Text 1- Chapter 1)<br>The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization. (Text 1- Chapter 2)</td><td>L1, L2</td></tr>
<tr><td colspan="3" align="center">Module-2</td><td></td></tr>
<tr><td colspan="3">Addressing Modes in 8051 Microcontroller: Introduction, Addressing Modes, External Data Moves, Code Memory Read only Data Moves, PUSH and POP opcodes, Data Exchanges, Example Programs. (Text 1- Chapter 3)</td><td>L1, L2</td></tr>
<tr><td colspan="3" align="center">Module-3</td><td></td></tr>
<tr><td colspan="3">Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. (Text 1- Chapter 4, 5 and 6)</td><td>L1, L2, L3</td></tr>
<tr><td colspan="3" align="center">Module-4</td><td></td></tr>
<tr><td colspan="3">8051 Microcontroller Interfacing and Applications: Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC interfacing and programming. (Text 2 – Chapter 12 and 13)</td><td>L1,L2, L3</td></tr>
<tr><td colspan="3" align="center">Module-5</td><td></td></tr>
<tr><td colspan="3">8051 Microcontroller Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C . (Text 2 – Chapter 9, Chapter 11 -11.1)<br>8051 Microcontroller Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C. (Text 2 – Chapter 10- 10.1,10.2, 10.3)</td><td>L1, L2, L3</td></tr>
<tr><td colspan="4">Course Outcomes: After studying this course, students will be able to:<br>1. Explain the basics of Microprocessor and Microcontroller<br>2. Relate to the 8051 Microcontroller architecture and Pin description<br>3. Analyze 8051 Addressing modes and use the 8051 instruction set<br>4. Program the on-chip peripherals in 8051<br>5. Design and develop applications using 8051 Assembly language and C program</td></tr>
<tr><td colspan="4">Students have to conduct the following experiments as a part of CIE marks along with other Activities:<br>1. Write an 8051 ALP to exchange n = 5 bytes of data at location 0027H and at location 0041H.<br>2. Write an 8051 ALP to sort an array of n = 6 bytes of data in ascending order stored from location 9000H.(use bubble sort algorithm)</td></tr>
</table>

3. Write an 8051 ALP to implement (display) an eight bit up/down binary (hex) counters on watch window.
4. Write a program to toggle all the bits of P1 and P2 continuously using CALL and RETURN instructions
5. Write an 8051 ALP to implement ASCII to hexadecimal conversion
6. Write a Program illustrating timer delay Generate a 1second delay continuously using the on-chip timer in interrupt mode.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. "The 8051 Microcontroller Architecture, Programming and Applications", Kenneth J Ayala, Thomson learning, 2005.
2. "The 8051 Microcontroller and Embedded Systems-using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D McKinaly, Pearson, 2006.

**Reference:**

"The 8051 Microcontroller: Hardware, Software and Applications" V. Udayashankara and Mallikarjuna Swamy, TMH., 2009.

## ADDITIONAL OPEN ELECTIVES-A OFFERED BY EC/TC BOARD

<table>
<tr><td colspan="4" align="center">B. E. EC/TE<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VI</td></tr>
<tr><td colspan="4" align="center">BASIC VLSI DESIGN</td></tr>
<tr><td>Course Code</td><td>18EC655</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40(8Hours/Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
<tr><td colspan="4">Course objective: This course will enable students to:<br>• Understand the fundamental aspects of circuits in silicon<br>• Relate to VLSI design processes and design rules</td></tr>
</table>

| Module-1 | RBT Level |
|---|---|
| Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, p-well processes, BiCMOS, Comparison of bipolar and CMOS.<br>**Basic Electrical Properties of MOS And BiCMOS Circuits**: Drain to source current versus voltage characteristics, threshold voltage, transconductance. | **L1, L2** |
| **Module-2** | |
| **Basic Electrical Properties of MOS And BiCMOS Circuits**: nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up.<br>**Basic Circuit Concepts**: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers. | **L1, L2** |
| **Module-3** | |
| **MOS and BiCMOS Circuit Design Processes**: MOS layers, stick diagrams, nMOS design style, CMOS design style<br>**Design rules and layout & Scaling of MOS Circuits**: λ - based design rules, scaling factors for device parameters | **L1, L2, L3** |
| **Module-4** | |
| **Subsystem Design and Layout-1**: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS<br>**Examples of structured design**: Parity generator, Bus arbitration, multiplexers, logic function block, code converter. | **L1,L2, L3** |
| **Module-5** | |
| **Subsystem Design and Layout-2**: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity-Definition & Computation<br>**Practical aspects and testability**: Some thoughts of performance, optimization and CAD tools for design and simulation. | **L1, L2, L3** |

**Course Outcomes:** After studying this course, students will be able to:

1. Identify the CMOS layout levels, and the design layers used in the process sequence.
2. Describe the general steps required for processing of CMOS integrated circuits.
3. Design static CMOS combinational and sequential logic at the transistor level.
4. Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.
5. Interpret the need for testability and testing methods in VLSI.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

"Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005.

**References:**

1. "CMOS Digital Integrated Circuits, Analysis And Design", Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3rd Edition, 2003.
2. "VLSI Technology", S.M. Sze, 2nd edition, Tata McGraw Hill, 2003.

# EMBEDDED SYSTEMS LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL66** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS– 02** | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

**Laboratory Experiments**

Conduct the following experiments on an ARM CORTEX M3 evaluation board to learn ALP and using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

**PART A:**

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.
3. ALP to find the number of 0's and 1's in a 32 bit data
4. ALP to find determine whether the given 16 bit is even or odd
5. ALP to write data to RAM

**PART B:**

6. Display "Hello world" message using internal UART
7. Interface and Control the speed of a DC Motor.
8. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
9. Interface a DAC and generate Triangular and Square waveforms.
10. Interface a 4x4 keyboard and display the key code on an LCD.
11. Demonstrate the use of an external interrupt to toggle an LED On/Off.
12. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay.
13. Measure Ambient temperature using a sensor and SPI ADC IC.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
2. Develop assembly language programs using ARM Cortex M3 for different applications.
3. Interface external devices and I/O with ARM Cortex M3.
4. Develop C language programs and library functions for embedded system applications.
5. Analyze the functions of various peripherals, peripheral registers and power saving modes of ARM Cortex M3

**Conduction of Practical Examination:**

- One Question from PART A and one Question from PART B to be asked in the examination.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

## COMMUNICATION LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL67** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to:

- Design and test the communication circuits for different analog modulation schemes.
- Design and demonstrate the digital modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Understand the probability of error computations of coherent digital modulation schemes.

**Laboratory Experiments**

**PART-A: Expt. 1 to Expt. 5 have to be performed using discrete components.**

1. Amplitude Modulation and Demodulation: i) Standard AM, ii)DSBSC (LM741 and LF398 ICs can be used)
2. Frequency modulation and demodulation ( IC 8038/2206 can be used)
3. Pulse sampling, flat top sampling and reconstruction
4. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
5. FSK and PSK generation and detection
6. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
7. Obtain the Radiation Pattern and Measurement of directivity and gain of microstrip dipole and Yagi antennas.
8. Determination of
    a. Coupling and isolation characteristics of microstrip directional coupler.
    b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
    c. Power division and isolation of microstrip power divider.

**PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabVIEW**

1. To Simulate NRZ, RZ, half-sinusoid & raised cosine pulses and generate eye diagram for binary polar signaling.
2. Pulse code modulation and demodulation system.

3. Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their performance curves.
4. Digital Modulation Schemes i) DPSK Transmitter and Receiver, ii) QPSK Transmitter and Receiver.

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Design and test circuits for analog modulation and demodulation schemes viz., AM, FM, etc.
2. Determine the characteristics and response of microwave waveguide.
3. Determine characteristics of microstrip antennas and devices & compute the parameters associated with it.
4. Design and test the digital and analog modulation circuits and display the waveforms.
5. Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.

**Conduct of Practical Examination:**

- All laboratory experiments are to be considered for practical examination.
- For examination one question from **PART-A** and one question from **PART-B or** only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

**B. E. 2018 Scheme Seventh Semester Syllabus (EC)**

**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

# SEMESTER – VII
# COMPUTER NETWORKS

| | | | |
|---|---|---|---|
| Course Code | : 18EC71 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs/module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
- Understand the protocols associated with each layer.
- Learn the different networking architectures and their representations.
- Learn the functions and services associated with each layer.

**Module-1**

**Introduction:** Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet.

**(1.1,1.2, 1.3(1.3.1to 1.3.4 of Text)**

**Network Models:** Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.

**(2.1, 2.2, 2.3 of Text)** **L1, L2**

**Module-2**

**Data-Link Layer:** Introduction: Nodes and Links, Services, Two Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking.

**(9.1, 9.2(9.2.1, 9.2.2), 11.1, 11.2of Text)**

**Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA.**(12.1 of Text)**

**Wired and Wireless LANs:** Ethernet Protocol, Standard Ethernet. Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control.

**(13.1, 13.2(13.2.1 to 13.2.5), 15.1 of Text)** **L1,L2, L3**

## Module-3

**Network Layer:** Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label.
**(18.1, 18.2, 18.4, 18.5.1, 18.5.2 of Text)**
**Network Layer Protocols:** Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. **(19.1of Text)**.
**Unicast Routing:** Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing.
**(20.1, 20.2of Text)** **L1,L2, L3**

## Module-4

**Transport Layer:** Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol. **(23.1, 23.2.1, 23.2.2, 23.2.3, 23.2.4 of Text)**
**Transport-Layer Protocols in the Internet:**
User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control.
**(24.2, 24.3.1, 24.3.2, 24.3.3, 24.3.4, 24.3.5, 24.3.6, 24.3.7, 24.3.8, 24.3.9 of Text)** **L1,L2, L3**

## Module-5

**Application Layer:** Introduction: providing services, Application- layer paradigms, Standard Client –Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Wed Based Mail, Telnet: Local versus remote logging.Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS, security of DNS.
**(25.1, 26.1, 26.2, 26.3, 26.4, 26.6 of Text)** **L1, L2**

**Course Outcomes:** At the end of the course, the students will be able to:

1. Understand the concepts of networking.
2. Describe the various networking architectures.
3. Identify the protocols and services of different layers.
4. Distinguish the basic network configurations and standards associated with each network.
5. Analyze a simple network and measure its parameters.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**TEXT BOOK:**


- Behrouz A Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.


**REFERENCE BOOKS:**


1. James J Kurose, Keith W Ross, "Computer Networks", Pearson Education.
2. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education.
3. Andrew S Tanenbaum, "Computer Networks", Prentice Hall.
4. William Stallings, "Data and Computer Communications", Prentice Hall.

# VLSI DESIGN

| | | | |
|---|---|---|---|
| Course Code | : 18EC72 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40(08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** The objectives of the course is to enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Learn the operation principles and analysis of inverter circuits.
- Design Combinational, sequential and dynamic logic circuits as per the requirements
- Infer the operation of Semiconductors Memory circuits.
- Demonstrate the concepts of CMOS testing

**Module-1**

**Introduction:** A Brief History, MOS Transistors, CMOS Logic
**(1.1 to 1.4 of TEXT2)**
**MOS Transistor Theory:** Introduction, Long-channel I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics
**(2.1, 2.2, 2.4 and 2.5 of TEXT2).**, **L1, L2**

**Module-2**

**Fabrication:** CMOS Fabrication and Layout, VLSI Design Flow, Introduction, CMOS Technologies, Layout Design Rules,
**(1.5 and 3.1 to 3.3 of TEXT2).**
MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitances
**(3.5 to 3.6 of TEXT1),** **L1, L2,**

**Module-3**

**Delay:** Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths **(4.1 to 4.5 of TEXT2, except sub-sections 4.3.7, 4.4.5, 4.4.6, 4.5.5 and 4.5.6).**
**Combinational Circuit Design:** Introduction, Circuit families
**(9.1 to 9.2 of TEXT2, except subsection 9.2.4).,** **L1, L2, L3**

**Module-4**

**Sequential Circuit Design:** Introduction, Circuit Design for Latches and Flip-Flops **(10.1 and 10.3.1 to 10.3.4 of TEXT2)**
**Dynamic Logic Circuits:** Introduction, Basic Principles of Pass Transistor Circuits, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques **(9.1, 9.2, 9.4 to 9.5 of TEXT1)**, **L1, L2, L3**

## Module-5

**Semiconductor Memories:** Introduction, Dynamic Random Access Memory (DRAM) and Static Random Access Memory (SRAM),
**(10.1 to 10.3 of TEXT1)**

**Testing and Verification:** Introduction, Logic Verification Principles, Manufacturing Test Principles, Design for testability
**(15.1, 15.3, 15.5 15.6.1 to 15.6.3 of TEXT 2).** **L1, L2**

**Course outcomes:** At the end of the course, the students will be able to:

1. Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
2. Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
3. Demonstrate ability to design Combinational, sequential and dynamic logic circuits as per the requirements
4. Interpret Memory elements along with timing considerations
5. Interpret testing and testability issues in VLSI Design

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**TEXT BOOKS:**


**1.** "CMOS Digital Integrated Circuits: Analysis and Design" - **Sung Mo Kang & Yosuf Leblebici,** Third Edition, Tata McGraw-Hill.

**2.** **"CMOS VLSI Design- A Circuits and Systems Perspective"-** Neil H. E. Weste and David Money Harris, 4th Edition, Pearson Education.


**REFERENCE BOOKS:**


1. Adel Sedra and K. C. Smith, "Microelectronics Circuits Theory and Applications", 6th or 7th Edition, Oxford University Press, International Version, 2009.
2. Douglas A Pucknell & Kamran Eshragian, "Basic VLSI Design", PHI 3rd Edition, (original Edition – 1994).
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH, 2007.

# REAL TIME SYSTEM

| | | | |
|---|---|---|---|
| Course Code | : 18EC731 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This Course will enable students to:

- Understand the fundamentals of Real-time systems and its classifications.
- Describe the concepts of computer control and hardware components for Real-Time Application.
- Discuss the languages to develop software for Real-Time Applications.
- Explain the concepts of operating system and RTS development methodologies.

**Module-1**

**Introduction to Real-Time Systems:** Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.

**Concepts of Computer Control:** Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems.

**(Text: 1.1 to 1.6 and 2.1 to 2.6),** **L1, L2**

**Module-2**

**Computer Hardware Requirements for Real-Time Applications:** Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.

**(Text: 3.1 to 3.8).** **L1, L2**

**Module-3**

**Languages for Real-Time Applications:** Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Cutlass, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages.

**(Text: 5.1 to 5.14).,** **L1,L2, L3**

**Module-4**

**Operating Systems:** Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time

Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.

**(Text: 6.1 to 6.11).** **L1, L2**

**Module-5**

**Design of RTS – General Introduction:** Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.

**RTS Development Methodologies:** Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method.

**(Text: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5).** **L1, L2, L3**

**Course Outcomes:** At the end of the course, students should be able to:

1. Explain the fundamentals of Real time systems and its classifications.
2. Understand the concepts of computer control and the suitable computer hardware requirements for real-time applications.
3. Describe the operating system concepts and techniques required for real time systems.
4. Develop the software algorithms using suitable languages to meet Real time applications.
5. Apply suitable methodologies to design and develop Real-Time Systems.

**Text Book:**

- Real-Time Computer Control, Stuart Bennet, 2nd Edn. Pearson Education. 2008.

**Reference Books:**

1. "Real –Time Systems", C.M. Krishna, Kang G. Shin, McGraw –Hill International Editions, 1997.
2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005.
3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005.

# SATELLITE COMMUNICATION

| | | | |
|---|---|---|---|
| Course Code | : 18EC732 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to

- Understand the basic principle of satellite orbits and trajectories.
- Study of electronic systems associated with a satellite and the earth station.
- Understand the various technologies associated with the satellite communication.
- Focus on a communication satellite and the national satellite system.
- Study of satellite applications focusing various domains services such as remote sensing, weather forecasting and navigation.

**Module-1**

**Satellite Orbits and Trajectories:** Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle. ,

**L1, L2**

**Module-2**

**Satellite subsystem:** Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload.

**Earth Station:** Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking.,

**L1, L2**

**Module-3**

**Multiple Access Techniques**: Introduction, FDMA (No derivation), SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA.

**Satellite Link Design Fundamentals**: Transmission Equation, Satellite Link Parameters, Propagation considerations

**L1,L2, L3**

**Module-4**

**Communication Satellites:** Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems.

**L1, L2**

## Module-5

**Remote Sensing Satellites**: Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications.
**Weather Forecasting Satellites**: Fundamentals, Images, Orbits, Payloads, Applications.
**Navigation Satellites**: Development of Satellite Navigation Systems, GPS system, Applications.,

**L1,L2, L3**

**Course Outcomes:** At the end of the course, the students will be able to:

1. Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
2. Describe the electronic hardware systems associated with the satellite subsystem and earth station.
3. Describe the communication satellites with the focus on national satellite system.
4. Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.
5. Describe the satellites used for applications in remote sensing, weather forecasting and navigation.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

- Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.

**Reference Books :**

1. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN: 978-81-265-0833-4

# DIGITAL IMAGE PROCESSING

| | | | |
|---|---|---|---|
| Course Code | : 18EC733 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to

- Understand the fundamentals of digital image processing.
- Understand the image transforms used in digital image processing.
- Understand the image enhancement techniques used in digital image processing.
- Understand the image restoration techniques and methods used in digital image processing.
- Understand the Morphological Operations used in digital image processing.

**Module1**

**Digital Image Fundamentals:** Whatis Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition.

**(Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.2, 2.6.2) L1,L2**

**Module-2**

**Image Enhancement in the Spatial Domain:** Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters

**(Text:Chapter2: Sections 2.3 to 2.62, Chapter3: Sections3.2 to 3.6)**, **L1,L2**

**Module-3**

Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

**(Text: Chapter4: Sections 4.2, 4.5 to 4.10)**, **L1,L2**

**Module-4**

Restoration: Noise models, Restorationin the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum

Mean Square Error(Wiener) Filtering, Constrained Least Squares Filtering.
**(Text: Chapter 5: Sections 5.2, to 5.9)** **L1,L2**

**Module-5**

**Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing.
**Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing.
**(Text: Chapter 6: Sections 6.1 to 6.3 Chapter 9: Sections9.1to9.3)**
**L1,L2**

**Course Outcomes:** At the end of the course, students should be able to:

1. Describe the fundamentals of digital image processing.
2. Understand image formation and the role human visual system plays in perception of gray and color image data.
3. Apply image processing techniques in both the spatial and frequency (Fourier) domains.
4. Design and evaluate image analysis techniques
5. Conduct independent study and analysis of Image Enhancement and restoration techniques.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

- Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

**Reference Books:**


1. Digital Image Processing- S. Jayaraman, S. Esakkirajan,T. Veerakumar, Tata Mc Graw Hill 2014.
2. Fundamentals of Digital Image Processing- A. K. Jain, Pearson 2004.
3. Image Processing analysis and Machine vision with Mind Tap by Milan Sonka and Roger Boile, Cengage Publications, 2018.

# DSP ALGORITHMS and ARCHITECTURE

| | | | |
|---|---|---|---|
| Course Code | : 18EC734 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Figure out the knowledge and concepts of digital signal processing techniques.
- Understand the computational building blocks of DSP processors and its speed issues.
- Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor.
- Learn how to interface the external devices to TMS320C54xx processor in various modes.
- Understand basic DSP algorithms with their implementation.

**Module -1**

**Introduction to Digital Signal Processing:**
Introduction, A Digital Signal – Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.
**Computational Accuracy in DSP Implementations:**
Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation.

**L1,L2**

**Module -2**

**Architectures for Programmable Digital Signal – Processing Devices:**
Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.

**L1,L2**

**Module -3**

**Programmable Digital Signal Processors:**
Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and

Programming, On – Chip Peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.

**L1,L2**

**Module -4**

**Implementation of Basic DSP Algorithms:**
Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).
**Implementation of FFT Algorithms:**
Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx.

**L1,L2**

**Module -5**

**Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices:**
Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).
**Interfacing and Applications of DSP Processors:**
Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

**L1,L2**

**Course Outcomes:** At the end of this course, students would be able to:
1. Comprehend the knowledge and concepts of digital signal processing techniques.
2. Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor.
3. Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
4. Develop basic DSP algorithms using DSP processors.
5. Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device and demonstrate the programming of CODEC interfacing.

**Question paper pattern:**
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.

- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**


- "Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning, 2004.


**Reference Books:**


1. "Digital Signal Processing: A practical approach", Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002.
2. "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, $2^{nd}$, 2010
3. "Architectures for Digital Signal Processing", Peter Pirsch John Wiley, 2008

# IoT & WIRELESS SENSOR NETWORKS

| | | | |
|---|---|---|---|
| Course Code | : 18EC741 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Describe the OSI Model for IoT/M2M Systems.
- Understand the architecture and design principles for device supporting IoT.
- Develop competence in programming for IoT Applications.
- Identify the uplink and downlink communication protocols which best suits the specific application of IoT / WSNs.

### Module-1

**Overview of Internet of Things:** IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT,XMPP) for IoT/M2M devices. – Refer Chapter 1, 2 and 3 of Text 1.

**L1, L2**

### Module-2

**Architecture and Design Principles for IoT:** Internet connectivity, Internet-based communication,IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports.

**Data Collection, Storage and Computing using a Cloud Platform:** Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing services using Nimbits. - Refer Chapter 4 and 6 of Text 1.

**L1, L2**

### Module-3

**Prototyping and Designing Software for IoT Applications:** Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development.
Programming MQTT clients and MQTT server. Introduction to IoT privacy

and security. Vulnerabilities, security requirements and threat analysis, IoT Security Tomography and layered attacker model. - Refer Chapter 9 and 10 of Text 1. **L1, L2, L3**

**Module-4**

**Overview of Wireless Sensor Networks:**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

**Architectures**: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts. - Refer Chapter 1, 2, 3 of Text 2.

**L1, L2, L3**

**Module-5**

**Communication Protocols:**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols(CSMA,PAMAS), Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. - Refer Chapter 4, 5, 7 and 11 of Text 2.

**L1, L2, L3**

**Course Outcomes:** At the end of the course, students will be able to:

1. Understand choice and application of IoT & M2M communication protocols.
2. Describe Cloud computing and design principles of IoT.
3. Relate to MQTT clients, MQTT server and its programming.
4. Describe the architectures and its communication protocols of WSNs.
5. Identify the uplink and downlink communication protocols associated with specific application of IOT / WSNs

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4sub questions.
- There will be 2 full questions from each module covering all the topics of the module.

- Students will have to answer 5full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. Raj Kamal, "Internet of Things-Architecture and design principles", McGraw Hill Education.
2. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.


**Reference Books:**


1. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
2. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols and Applications", John Wiley, 2007.
3. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

# AUTOMOTIVE ELECTRONICS

| | | | |
|---|---|---|---|
| Course Code | : 18EC742 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the basics of automobile dynamics and design electronics to complement those features.
- Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts.

**Module -1**

**Automotive Fundamentals Overview** – Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System (Text 1: Chapter1), Starter Battery –Operating principle:
**(Text 2: Pg. 407-410)**
**The Basics of Electronic Engine Control –** Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Analysis of intake manifold pressure, Electronic Ignition.
**(Text 1: Chapter 5)** **L1, L2**

**Module -2**

**Automotive Sensors** – Automotive Control System applications of Sensors and Actuators – Variables to be measured, Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, Piezoelectric Knock Sensor. **(Text 1: Chapter 6)**
**Automotive Engine Control Actuators –** Solenoid, Fuel Injector, EGR Actuator, Ignition System
**(Text 1: Chapter 6)** **L1, L2**

**Module -3**

**Digital Engine Control Systems –** Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System - Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics. **(Text 1: Chapter 7)**

**Control Units –** Operating conditions, Design, Data processing, Programming, Digital modules in the Control unit, Control unit software.

**(Text 2: Pg. 196-207)** **L1, L2**

**Module -4**

**Automotive Networking** –Bus Systems – Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles

**(Text 2: Pg. 85-91),**

Buses - CAN Bus, LIN Bus, MOST Bus, Bluetooth, Flex Ray, Diagnostic Interfaces. **(Text 2: Pg. 92-151)**

**Vehicle Motion Control** – Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS)

**(Text 1: Chapter 8)** **L1,L2**

**Module -5**

**Automotive Diagnostics**–Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag systems. **(Text 1: Chapter 10)**

**Future Automotive Electronic Systems** – Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control

**(Text 1: Chapter 11)** **L1, L2,L3**

**Course Outcomes:** At the end of the course, students will be able to:

1. Describe the basics of automobile dynamics and design electronics.
2. Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry.
3. Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.

4. Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems.
5. Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier Publishing.
2. Robert Bosch GmbH (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley & Sons Inc., 2007.

# MULTIMEDIA COMMUNICATION

| | | | |
|---|---|---|---|
| Course Code | : 18EC743 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the importance of multimedia in today's online and offline information sources and repositories.
- Understand the how Text, Audio, Image and Video information can be represented digitally in a computer so that it can be processed, transmitted and stored efficiently.
- Understand the Multimedia Transport in Wireless Networks
- Understand the Real-time multimedia network applications.
- Understand the Different network layer based application.

### Module -1

**Multimedia Communications:** Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology.

**(Chapter 1 of Text 1)** **L1,L2**

### Module -2

**Information Representation:** Introduction, Digitization principles, Text, Images, Audio and Video.

**(Chapter 2 of Text 1)** **L1,L2**

### Module -3

**Text and Image Compression:** Introduction, Compression principles, text compression, image Compression.**(Chapter 3 of Text 1)**

**Distributed Multimedia Systems:** Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia Operating Systems.

**(Chapter 4 - Sections 4.1 to 4.5 of Text 2)**, **L1,L2**

### Module -4

**Audio and video compression:** Introduction, Audio compression, video compression, video compression principles, video compression.

**(Chapter 4 of Text 1)** **L1,L2**

**Module -5**

**Multimedia Information Networks:** Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol**(Chap. 8 of Text 1).**

**The Internet:** Introduction, IP Datagrams, Fragmentation, IPAddress, ARP and RARP, QoS Support, IPv8.

**(Chap. 9 of Text 1)**, **L1,L2**

**Course Outcomes:** After studying this course, students will be able to:

1. Understand basics of different multimedia networks and applications.
2. Understand different compression techniques to compress audio and video.
3. Describe multimedia Communication across Networks.
4. Analyse different media types to represent them in digital form.
5. Compress different types of text and images using different compression techniques.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. Multimedia Communications- Fred Halsall, Pearson Education, 2001, ISBN -9788131709948.
2. Multimedia Communication Systems- K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Pearson Education, 2004. ISBN -9788120321458.

**Reference Book:**

- Multimedia: Computing, Communications and Applications- Raifsteinmetz, Klara Nahrstedt, Pearson Education,2002.ISBN-978817758

# CRYPTOGRAPHY

| | | | |
|---|---|---|---|
| Course Code | : 18EC744 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the basics of symmetric key and public key cryptography.
- Explain classical cryptography algorithms.
- Acquire knowledge of mathematical concepts required for cryptography.
- Describe pseudo random sequence generation technique.
- Explain symmetric and asymmetric cryptography algorithms.

**Module -1**

**Classical Encryption Techniques:** Symmetric cipher model, Substitution techniques, Transposition techniques **(Text 1: Chapter 1)**
**Basic Concepts of Number Theory and Finite Fields:** Euclidean algorithm, Modular arithmetic
**(Text 1: Chapter 3)** **L1,L2**

**Module -2**

**SYMMETRIC CIPHERS:** Traditional Block Cipher structure, Data encryption standard (DES), The AES Cipher.
**(Text 1: Chapter 2: Section1, 2, Chapter 4:Section 2, 3, 4)** **L1,L2**

**Module -3**

**Basic Concepts of Number Theory and Finite Fields:** Groups, Rings and Fields, Finite fields of the form GF(p), Prime Numbers, Fermat's and Euler's theorem, discrete logarithm.
**(Text 1: Chapter 3 and Chapter 7: Section 1, 2, 5),** **L1,L2**

**Module -4**

**ASYMMETRIC CIPHERS:** Principles of Public-Key Cryptosystems, The RSA algorithm, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography
**(Text 1: Chapter 8, Chapter 9: Section 1, 3, 4)** **L1,L2,L3**

**Module -5**

**Pseudo-Random-Sequence Generators and Stream Ciphers:**
Linear Congruential Generators, Linear Feedback Shift Registers, Design and

analysis of stream ciphers, Stream ciphers using LFSRs, A5, Hughes XPD/KPD, Nanoteq, Rambutan, Additive generators, Gifford, Algorithm M,PKZIP **(Text 2: Chapter 16)**, **L1,L2, L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Explain basic cryptographic algorithms to encrypt and decrypt the data.
2. Use symmetric and asymmetric cryptography algorithms to encrypt and decrypt the information.
3. Describe the mathematics associated with cryptography.
4. Apply concepts of modern algebra in cryptography algorithms.
5. Apply pseudo random sequence in stream cipher algorithms.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. William Stallings , "Cryptography and Network Security Principles and Practice", Pearson Education Inc., $6^{th}$ Edition, 2014, ISBN: 978-93-325-1877-3
2. Bruce Schneier, "Applied Cryptography Protocols, Algorithms, and Source code in C", Wiley Publications, $2^{nd}$ Edition, ISBN: 9971-51-348-X.

**Reference Books:**

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

# MACHINE LEARNING WITH PYTHON

| | | | |
|---|---|---|---|
| Course Code | : 18EC745 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

**Module – 1**

**Introduction:** Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

**Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

**Python libraries suitable for Machine Learning:** Numerical Analysis and Data Exploration with NumPy Arrays, and Data Visualization with Matplotlib

**Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7** **L1 - L5**

**Module – 2**

**Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. Example program in Python

**Text Book1, Sections: 3.1-3.7** **L1 - L3**

**Module – 3**

**Artificial Neural Networks :** Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm. Example program in Python

**Text book 1, Sections: 4.1 – 4.6** **L1 - L3**

**Module – 4**

**Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm, Example program in Python.

**Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12** **L1 - L4**

## Module – 5

**Evaluating Hypothesis:** Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.

**Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,

**Reinforcement Learning:** Introduction, Learning Task, Q Learning Example program in Python.

**Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3 L1 - L3**

**Course Outcomes:** After studying this course, students will be able to

1. Identify the problems in machine learning.
2. Select supervised, unsupervised or reinforcement learning for problem solving.
3. Apply theory of probability and statistics in machine learning
4. Apply concept learning, ANN, Bayes classifier, k nearest neighbor
5. Perform statistical analysis of machine learning techniques.

**Question paper pattern:**

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

**Reference Books:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydýn, Introduction to machine learning, second edition, MIT press.
3. https://www.analyticsvidhya.com/blog/2015/04/comprehensive-guide-data-exploration-sas-using-python-numpy-scipy-matplotlib-pandas/
4. https://www.oreilly.com/library/view/python-for-data/9781491957653/ch01.html

# COMPUTER NETWORKS LAB

| | | |
|---|---|---|
| Course Code : **18ECL76** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to:

- Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
- Design a suitable network and simulate using a Network simulator tool.
- Simulate the networking concepts and protocols using C/C++ programming.
- Model the networks for different configurations and analyze the results.

**Laboratory Experiments**

**PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool**

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
5. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
6. Implementation of Link state routing algorithm.

**PART-B: Implement the following in C/C++**

1. Write a program for a HLDC frame to perform the following.
   i) Bit stuffing
   ii) Character stuffing.
2. Write a program for distance vector algorithm to find suitable path for transmission.
3. Implement Dijkstra's algorithm to compute the shortest routing path.

4. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
   a. Without error
   b. With error
5. Implementation of Stop and Wait Protocol and Sliding Window Protocol
6. Write a program for congestion control using leaky bucket algorithm.

**Course outcomes:** On the completion of this laboratory course, the students will be able to:

1. Choose suitable tools to model a network.
2. Use the network simulator for learning and practice of networking algorithms.
3. Illustrate the operations of network protocols and algorithms using C programming.
4. Simulate the network with different configurations to measure the performance parameters.
5. Implement the data link and routing protocols using C programming.

**Conduct of Practical Examination:**

- All laboratory experiments are to be included for practical examination.
- For examination one question from software and one question from hardware or only one hardware experiments based on the complexity to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

# VLSI LABORATORY

| | | |
|---|---|---|
| Course Code : **18ECL77** | CIE Marks : 40 | SEE Marks : 60 |
| Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory | | |
| RBT Level : L1, L2, L3 | Exam Hours : 03 | |
| **CREDITS – 02** | | |

**Course Learning Objectives:** This course will enable students to:

- Design, model, simulate and verify CMOS digital circuits
- Design layouts and perform physical verification of CMOS digital circuits
- Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist
- Perform RTL-GDSII flow and understand the stages in ASIC design

**Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind**

**Laboratory Experiments**

**Part – A**

**Analog Design**

**Use any VLSI design tools to carry out the experiments, use library files and technology files below 180 nm.**

1.a) Capture the schematic of CMOS inverter with load capacitance of 0.1pF and set the widths of inverter with Wn = Wp, Wn = 2Wp, Wn = Wp/2 and length at selected technology. Carry out the following:

i. Set the input signal to a pulse with rise time, fall time of 1ns and pulse width of 10ns and time period of 20ns and plot the input voltage and output voltage of designed inverter?

ii. From the simulation results compute tpHL, tpLH and td for all three geometrical settings of width?

iii. Tabulate the results of delay and find the best geometry for minimum delay for CMOS inverter?

1. b) Draw layout of inverter with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

2. a) Capture the schematic of 2-input CMOS NAND gate having similar delay as that of CMOS inverter computed in experiment 1. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase the drive strength to 2X and 4X and tabulate the results.

2. b) Draw layout of NAND with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

3. a) Capture schematic of Common Source Amplifier with PMOS Current Mirror Load and find its transient response and AC response? Measures the Unity Gain Bandwidth (UGB), amplification factor by varying transistor geometries, study the impact of variation in width to UGB.

3. b) Draw layout of common source amplifier, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

4.a) Capture schematic of two-stage operational amplifier and measure the following:

- i. UGB
- ii. dB bandwidth
- iii. Gain margin and phase margin with and without coupling capacitance
- iv. Use the op-amp in the inverting and non-inverting configuration and verify its functionality
- v. Study the UGB, 3dB bandwidth, gain and power requirement in op-amp by varying the stage wise transistor geometries and record the observations.

4.b) Draw layout of two-stage operational amplifier with minimum transistor width set to 300 (in 180/90/45 nm technology), choose appropriate transistor geometries as per the results obtained in 4.a. Use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

## Part - B

**Digital Design**

**Carry out the experiments using semicustom design flow or ASIC design flow, use technology library 180/90/45nm and below**

**Note:** The experiments can also be carried out using FPGA design flow, it is required to set appropriate constraints in FPGA advanced synthesis options

1. Write verilog code for 4-bit up/down asynchronous reset counter and carry out the following:
   - a. Verify the functionality using test bench
   - b. Synthesize the design by setting area and timing constraint. Obtain

the gate level netlist, find the critical path and maximum frequency of operation. Record the area requirement in terms of number of cells required and properties of each cell in terms of driving strength, power and area requirement.

c. Perform the above for 32-bit up/down counter and identify the critical path, delay of critical path, and maximum frequency of operation, total number of cells required and total area.

2. Write verilog code for 4-bit adder and verify its functionality using test bench. Synthesize the design by setting proper constraints and obtain the net list. From the report generated identify critical path, maximum delay, total number of cells, power requirement and total area required. Change the constraints and obtain optimum synthesis results.
3. Write verilog code for UART and carry out the following:
    a. Perform functional verification using test bench
    b. Synthesize the design targeting suitable library and by setting area and timing constraints
    c. For various constrains set, tabulate the area, power and delay for the synthesized netlist
    d. Identify the critical path and set the constraints to obtain optimum gate level netlist with suitable constraints
4. Write verilog code for 32-bit ALU supporting four logical and four arithmetic operations, use case statement and if statement for ALU behavioral modeling.
    a. Perform functional verification using test bench
    b. Synthesize the design targeting suitable library by setting area and timing constraints
    c. For various constrains set, tabulate the area, power and delay for the synthesized netlist
    d. Identify the critical path and set the constraints to obtain optimum gate level netlist with suitable constraints

    Compare the synthesis results of ALU modeled using IF and CASE statements.
5. Write verilog code for Latch and Flip-flop, Synthesize the design and compare the synthesis report (D, SR, JK).
6. For the synthesized netlist carry out the following for any two above experiments:
    a. Floor planning (automatic), identify the placement of pads
    b. Placement and Routing, record the parameters such as no. of layers used for routing, flip method for placement of standard cells, placement of standard cells, routes of power and ground, and routing of standard cells
    c. Physical verification and record the LVS and DRC reports

d. Perform Back annotation and verify the functionality of the design
e. Generate GDSII and record the number of masks and its color composition

**Course Outcomes:** On the completion of this laboratory course, the students will be able to:

1. Design and simulate combinational and sequential digital circuits using Verilog HDL
2. Understand the Synthesis process of digital circuits using EDA tool.
3. Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list
4. Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
5. Perform RTL-GDSII flow and understand the stages in ASIC design.

# COMMUNICATION THEORY

| | | | |
|---|---|---|---|
| Course Code | : 18EC751 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Describe essential elements of an electronic communications.
- Understand Amplitude, Frequency & Phase modulations, and Amplitude demodulation.
- Explain the basics of sampling and quantization.
- Understand the various digital modulation schemes.
- The concepts of wireless communication.

**Module -1**

**Introduction to Electronic Communications:** Historical perspective, Electromagnetic frequency spectrum, signal and its representation, Elements of electronic communications system, primary communication resources, signal transmission concepts, Analog and digital transmission, Modulation, Concept of frequency translation, Signal radiation and propagation

**(Text 1: 1.1 to1.10)**

**L1, L2**

**Module -2**

**Noise:** Classification and source of noise **(TEXT 1:3.1)**

**Amplitude Modulation Techniques:** Types of analog modulation, Principle of amplitude modulation, AM power distribution, Limitations of AM,

**(TEXT 1: 4.1,4.2, 4.4, 4.6)**

**Angle Modulation Techniques:** Principles of Angle modulation, Theory of FM-basic Concepts, Theory of phase modulation **(TEXT 1: 5.1,5.2, 5.5)**

**Analog Transmission and Reception:** AM Radio transmitters, AM Radio Receivers

**(TEXT 1:6.1,6.2)**

**L1, L2**

**Module -3**

**Sampling Theorem and pulse Modulation Techniques**: Digital Versus analog Transmissions, Sampling Theorem, Classification of pulse modulation techniques, PAM, PWM, PPM, PCM, Quantization of signals

**(TEXT 1: 7.1 to 7.8)**

**L1, L2**

## Module -4

**Digital Modulation Techniques:** Types of digital Modulation, ASK,FSK,PSK,QPSK

**(TEXT 1: 9.1 to 9.5)**

**Source and Channel Coding:** Objective of source coding, source coding technique, Shannon's source coding theorem, need of channel coding, Channel coding theorem, error control and coding

**(TEXT 1: 11.1 to 11.3, 11.8, 11.9,11.12)**

**L1, L2**

## Module -5

**Evolution of wireless communication systems:** Brief History of wireless communications, Advantages of wireless communication, disadvantages of wireless communications, wireless network generations, Comparison of wireless systems, Evolution of next-generation networks, Applications of wireless communication

**(TEXT 2: 1.1 to 1.7)**

**Principles of Cellular Communications:** Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Method of locating cochannel cells, Frequecy reuse distance

**(TEXT 2: 4.1 to 4.7)**

**L1, L2**

**Course Outcomes:** At the end of the course, students will be able:

1. Describe operation of communication systems.
2. Understand the techniques of Amplitude and Angle modulation.
3. Understand the concept of sampling and quantization.
4. Understand the concepts of different digital modulation techniques.
5. Describe the principles of wireless communications system.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

1. Analog and Digital Communications by T L Singal, McGraw Hill Education (India) Private Limited.
2. Wireless Communications by T L Singal, McGraw Hill Education (India) Private Limited.

**Reference Books:**


1. Modern Digital and Analog Communication Systems B. P. Lathi, Oxford University Press., 4th ed, 2010,
2. Communication Systems: Analog and Digital, R.P.Singh and S.Sapre: TMH 2nd edition, 2007
3. Introduction to Wireless Telecommunications systems and Networks by Gray J Mullett, Cengage learning.

# NEURAL NETWORKS

| | | | |
|---|---|---|---|
| Course Code | : 18EC752 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the basics of ANN and comparison with Human brain.
- Acquire knowledge on Generalization and function approximation of various ANN architectures.
- Understand reinforcement learning using neural networks
- Acquire knowledge of unsupervised learning using neural networks.

**Module -1**

**Introduction**: Biological Neuron – Artificial Neural Model -Types of activation functions – **Architecture**: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

**Learning:** Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem. **L1,L2**

**Module -2**

**Supervised Learning:** Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.

**L1,L2,L3**

**Module -3**

**Support Vector Machines and Radial Basis Function:**

Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

**Module -4**

**Attractor Neural Networks**: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield

Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

**L1,L2,L3**

**Module -5**

**Self -organization Feature Map:** Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self -organization Feature Maps, Application of SOM, Growing Neural Gas.

**L1,L2,L3**

**Course Outcomes:** At the end of the course, students should be able to:

1. Describe the basics of ANN and comparison with Human brain.
2. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
3. Understand the concepts and techniques of neural networks through the study of the most important neural network models.
4. Evaluate whether neural networks are appropriate to a particular application.
5. Apply neural networks to particular application, and to know what steps to take to improve performance.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

- **Neural Networks A Classroom Approach** –Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

**Reference Books:**

1. **Introduction to Artificial Neural Systems -** J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks-** B. Yegnanarayana, PHI, New Delhi 1998.

## ADDITIONAL OPEN ELECTIVES-B OFFERED BY EC/TC BOARD

<table>
<tr><td colspan="4" align="center">B. E. EC/TE<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VII</td></tr>
<tr><td colspan="4" align="center">ARM EMBEDDED SYSTEMS</td></tr>
<tr><td>Course Code</td><td>18EC753</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40(8Hours/Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
<tr><td colspan="4">Course objective: This course will enable students to:<ul><li>Understand the importance and applications of ARM Design</li><li>Know the architecture of ARM processor</li><li>Use instruction sets of ARM processor</li><li>Analyze the adaptation of C code, firmware, OS, Interrupts, caches, etc. in ARM embedded systems</li></ul></td></tr>
</table>

| Module-1 | RBT Level |
|---|---|
| **ARM Embedded Systems**<br>Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications.<br>**ARM Processor Fundamentals**<br>ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions. | **L1, L2** |
| **Module-2** | |
| **Introduction to the ARM Instruction set**<br>Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, Conditional Execution. ALP programming. | **L1, L2, L3** |
| **Module-3** | |
| **Introduction to the THUMB instruction set**<br>Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions. ALP programming | **L1, L2, L3** |
| **Module-4** | |
| **Efficient C Programming:** Overview of C Compilers and optimization, Basic C data types, Local Variable Types, Portability issues<br>**Exception and Interrupt Handling:** Exception Handling-ARM Processor Exceptions and Modes, Vector Table, Exception Priorities, Link Register Offset, Interrupts- Interrupt Latency, Basic Interrupt Stack design and implementation, Interrupt Handling Schemes (**general description only** of the schemes) | **L1, L2, L3, L4** |
| **Module-5** | |
| **Firmware:** Firmware and Bootloader<br>**Embedded Operating Systems:** Fundamental Components<br>**Caches:** The memory Hierarchy and caches memory-caches and memory management units, Cache architecture basic architecture of caches memory, basic operation of cache controller, the relationship between cache and main memory. | **L1, L2** |

**Course Outcomes:** After studying this course, students will be able to:

1. Depict the organization, architecture, bus technology, memory and operation of the ARM processors
2. Employ the knowledge of Instruction set of ARM processors to develop basic Assembly Language Programs
3. Recognize the importance of the Thumb mode of operation of ARM processors
4. Describe the techniques involved in writing C code for ARM processors and Exception & Interrupt handling in ARM Processors
5. Describe the importance and use of Firmware, OS and cache in ARM Embedded systems

Students have to conduct the following experiments as a part of CIE marks along with other Activities:

Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation simulator and the required software tool.

1. Write an ALP to find the sum of 10 integer numbers.
2. Write an ALP to multiply two 16-bit binary numbers.
3. Write an ALP to find factorial of a number.
4. Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM
5. Write an ALP to find the square of a number (1 to 10) using look-up table.
6. Write an ALP to find the largest/smallest number in an array of 32 numbers.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

“ARM System Developers Guide”, Andrew N Sloss, Dominic System and Chris Wright, Elsevier, Morgan Kaufmann publisher, 1st Edition, 2008, ISBN:1758608745.

**References:**


1. “ARM System on chip Architecture”, Furber S, Addison Wiley, 2nd Edition, 2008, ISBN:9780201675191
2. “Embedded System”, Rajkamal, Tata McGraw-Hill Publishers, 2nd Edition, 2008, ISBN: 0070494703.

## ADDITIONAL OPEN ELECTIVES-B OFFERED BY EC/TC BOARD

<table>
<tr><td colspan="4" align="center">B. E. EC/TE<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VII</td></tr>
<tr><td colspan="4" align="center">DIGITAL SYSTEMS DESIGN USING VHDL</td></tr>
<tr><td>Course Code</td><td>18EC754</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40(8Hours/Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 03</td></tr>
<tr><td colspan="4">Course objective: This course will enable students to:<ul><li>Use the industry-standard hardware description language VHDL into the digital design process.</li><li>Design VHDL models ranging in complexity from a simple adder to more complex circuits.</li><li>Understand the synthesis and testing of the models.</li></ul></td></tr>
</table>

| Module-1 | RBT Level |
|---|---|
| **Review of Logic Design Fundamentals:**<br>Combinational logic, Boolean Algebra and Algebraic Simplification, Karnaugh maps, Designing with NAND and NOR gates, Hazards in combinational Networks, Flipflop and Latches, Mealy Sequential Network Design, Design of Moore Sequential Network, Equivalent states and reduction of state Tables, Synchronous Design, Tristate Logic and Buses (Text 1, Chapter 1- 1.1 to 1.9, 1.12, 1.13) | **L1, L2, L3** |
| **Module-2** | |
| **Introduction to VHDL:** VHDL Description of Combinational Networks, Modeling Flip-flops using VHDL Processes, VHDL Models for a Multiplexer, Modeling a sequential Machine, Variables, signals, and constants, Arrays, VHDL operators, VHDL Functions, VHDL Procedures, Packages and Libraries. (Text 1, Chapter 2- 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11) | **L1, L2, L3** |
| **Module-3** | |
| **Styles of Descriptions**: VHDL Data types, VHDL Styles of Description (Text 2, Chapter 1- 1.5, 1.6)<br>**Data flow Description**: Highlights of Data flow Description, Structure of Data flow Description, Data type-vectors, Common VHDL programming Errors (Text 2, Chapter 2- 2.1- to- 2.4) | **L1, L2, L3** |
| **Module-4** | |
| **Designing with programmable Logic Devices**: Read only memories, Programmable Logic Arrays, Programmable Array Logic, Other sequential programmable Logic Devices (PLDs), Generics, Generate statements. (Text 1, Chapter 3- 3.1, 3.2, 3.3, 3.4)<br>**Design of Networks for Arithmetic Operations:** Design of serial Adder with Accumulator, Design of Binary Multiplier, Multiplication of signed Binary Numbers, Design of Binary Divider (Text 1, Chapter 4- 4.1, 4.3, 4.4, 4.5) | **L1, L2, L3** |
| **Module-5** | |
| **Synthesis**: Highlights of synthesis, synthesis information from entity and module, Mapping process in the hardware domain- Mapping of signal assignment, variable | **L1, L2, L3** |

| | |
|---|---|
| assignment, if statements, else-if statements, loop statement. (Text 2, Chapter5- 10.1, 10.2, 10.3)<br><br>**Hardware Testing and Design for Testability**: Testing Combinational Logic, Testing Sequential Logic. (Text 1, Chapter 10- 10.1, 10.2)) | |

**Course Outcomes:** After studying this course, students will be able to:

1. Understand the basic concepts of Digital Design
2. Implement various Combinational and sequential circuits using VHDL descriptions. Write simple VHDL programs in different styles.
3. Design and verify the functionality of digital circuits (PLA, PAL, PLD) and Arithmetic Operations.
4. Identify the suitable Abstraction level for a particular digital design.
5. Write the programs more effectively using Verilog tasks and directives. Perform timing and delay Simulation.

Students have to conduct the following experiments as a part of CIE marks along with other Activities:

Conduct the following experiments using an suitable simulator and the required software tool.

1. Write a VHDL code to implement half and full adder using Data flow style.
2. Write a VHDL code to realize various logic gates.
3. Write a VHDL code to implement four-bit full adder using structural style.
4. Write a VHDL code to implement 2*2 unsigned combinational Array Multiplier.
5. Write a VHDL code to implement D Latch.
6. Implement JK flip flop modeling using VHDL process

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**


1. "Digital Systems Design using VHDL", Charles H. Roth, Jr., The University of Texas at Austin. 2006 reprint, Thomson Asia Pte Ltd, Singapore
2. "HDL Programming VHDL and Verilog", Nazeih M. Botros, 2009 reprint, Dreamtech press


**Reference:**


"VHDL for Programmable Logic", Kevin Skahill, Pearson education, 2006

## B. E. 2018 Scheme Eighth Semester Syllabus (EC)

**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

## SEMESTER – VIII

## WIRELESS and CELLULAR COMMUNICATION

| | | | |
|---|---|---|---|
| Course Code | : 18EC81 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| | CREDITS – 03 | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the concepts of propagation over wireless channels from a physics standpoint
- Application of Communication theory both Physical and networking to understand GSM systems that handle mobile telephony
- Application of Communication theory both Physical and networking to understand CDMA systems that handle mobile telephony.
- Application of Communication theory both Physical and networking to understand LTE-4G systems.

### Module-1

**Mobile Radio Propagation –**

Large Scale Path Loss - Free Space Propagation Model, Relating Power to Electric Field, Three Basic Propagation Mechanisms – Reflection (Ground Reflection) , Diffraction, Scattering, Practical Link Budget,

**( Text 1 - 2.2 and Ref1 - Chapter 4)**

**Fading and Multipath** – Broadband wireless channel, Delay Spread and Coherence Bandwidth, Doppler Spread and Coherence Time, Angular spread and Coherence Distance **(Text 1 – 2.4)**

Statistical Channel Model of a Broadband Fading Channel

**(Text 1 – 2.5.1)**

**The Cellular Concept** – Cellular Concept , Analysis of Cellular Systems, Sectoring

**(Text 1- 2.3)** **L1, L2**

### Module-2

**GSM and TDMA Technology**

**GSM System overview** – Introduction, GSM Network and System Architecture, GSM Channel Concept.

**GSM System Operations** – GSM Identities, System Operations –Traffic cases, GSM Infrastructure Communications (Um Interface)

**(Text 2, Part1 and Part 2 of Chapter 5)** **L1,L2,L3**

**Module-3**

**CDMA Technology**

**CDMA System Overview** – Introduction, CDMA Network and System Architecture

**CDMA Basics** – CDMA Channel Concepts, CDMA System (Layer 3) operations, 3G CDMA

**(Text 2-Part 1, Part2 and Part 3 of Chapter 6)** **L1,L2,L3**

**Module-4**

**LTE – 4G**

**Key Enablers for LTE 4G** – OFDM, SC-FDE, SC-FDMA, Channel Dependant Multiuser Resource Scheduling, Multi-Antenna Techniques, Flat IP Architecture, LTE Network Architecture. **(Text 1, Sec 1.4)**

**Multi-Carrier Modulation –** Multicarrier concepts, OFDM Basics, OFDM in LTE, Timing and Frequency Synchronization, Peak to Average Ration, SC-Frequency Domain Equalization, Computational Complexity Advantage of OFDM and SC-FDE.

**(Text 1, Sec 3.1 – 3.7)** **L1,L2,L3**

**Module-5**

**LTE - 4G**

**OFDMA and SC-FDMA –** Multiple Access for OFDM Systems, OFDMA, SCFDMA, Multiuser Diversity and Opportunistic Scheduling, OFDMA and SC-FDMA in LTE, OFDMA system Design Considerations.

**(Text 1, Sec 4.1 – 4.6)**

**The LTE Standard –** Introduction to LTE and Hierarchical Channel Structure of LTE, Downlink OFDMA Radio Resources, Uplink SC-FDMA Radio Resources.

**(Text 1, Sec 6.1 – 6.4)** **L1, L2,L3**

**Course Outcomes:** After studying this course, students will be able to:

1. Understand the Communication theory both Physical and networking associated with GSM, CDMA & LTE 4G systems.
2. Explain concepts of propagation mechanisms like Reflection, Diffraction, Scattering in wireless channels.
3. Develop a scheme for idle mode, call set up, call progress handling and call tear down in a GSM cellular network.

4. Develop a scheme for idle mode, call set up, call progress handling and call tear down in a CDMA cellular network.
5. Understand the Basic operations of Air interface in a LTE 4G system.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. "Fundamentals of LTE" Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Pearson education (Formerly Prentice Hall, Communications Engg and Emerging Technologies), ISBN-13: 978-0-13-703311-9.
2. "Introduction to Wireless Telecommunications Systems and Networks", Gary Mullet, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN - 13: 978-81-315-0559-5.

**Reference Books:**

1. "Wireless Communications: Principles and Practice" Theodore Rappaport, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.
2. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003. 2

# NETWORK SECURITY

| | | | |
|---|---|---|---|
| Course Code | : 18EC821 | CIE Marks | : 40 |
| Lecture Hours/Week | : 3 | SEE Marks | : 60 |
| Total Number of Lecture Hours : 40 (08 Hrs / Module) | | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Describe network security services and mechanisms.
- Understand Transport Level Security and Secure Socket Layer
- Know about Security concerns in Internet Protocol security
- Discuss about Intruders, Intrusion detection and Malicious Software
- Discuss about Firewalls, Firewall characteristics, Biasing and Configuration

### Module-1

Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks.

**(Chapter1-Text2)** **L1, L2**

### Module-2

Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH)

**(Chapter15- Text1)** **L1,L2**

### Module-3

IP Security: Overview of IP Security (IPSec),IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

**(Chapter19-Text1)** **L1,L2**

### Module-4

Intruders, Intrusion Detection.**(Chapter20-Text1)**

**MALICIOUS SOFTWARE:** Viruses and Related Threats, Virus Counter measures,

**(Chapter21-Text1)** **L1,L2**

### Module-5

Firewalls: The Need for firewalls, Firewall Characteristics, Types of Firewalls, Firewall Biasing, Firewall location and configuration

**(Chapter22-Text 1)** **L1, L2**

**Course Outcomes:** After studying this course, students will be able to:

1. Explain network security services and mechanisms and explain security concepts
2. Understand the concept of Transport Level Security and Secure Socket Layer.
3. Explain Security concerns in Internet Protocol security
4. Explain Intruders, Intrusion detection and Malicious Software
5. Describe Firewalls, Firewall Characteristics, Biasing and Configuration

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**TEXT BOOKS:**


1. Cryptography and Network Security Principles and Practice , Pearson Education Inc., William Stallings, 5th Edition, 2014, ISBN: 978-81-317- 6166-3.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.


**REFERENCE BOOKS:**


1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.

# MICRO ELECTRO MECHANICAL SYSTEMS

| | | | |
|---|---|---|---|
| Course Code | : 18EC822 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (8 Hrs /Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand overview of microsystems, their fabrication and application areas.
- Working principles of several MEMS devices.
- Develop mathematical and analytical models of MEMS devices.
- Know methods to fabricate MEMS devices.
- Various application areas where MEMS devices can be used.

**Module-1**

**Overview of MEMS and Microsystems**: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets.

**L1, L2**

**Module-2**

**Working Principles of Microsystems**: Introduction, Microsensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfluidics.

**Engineering Science for Microsystems Design and Fabrication:** Introduction, Molecular Theory of Matter and Inter-molecular Forces, Plasma Physics, Electrochemistry.

**L1,L2**

**Module-3**

**Engineering Mechanics for Microsystems Design:** Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis.

**L1,L2**

**Module-4**

**Scaling Laws in Miniaturization**: Introduction, Scalingin Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer.

**L1,L2**

## Module-5

**Overview of Micromanufacturing**: Introduction, Bulk Micromanufacturing, Surface Micromachining, The LIGA Process, Summary on Micro manufacturing.

**L1, L2**

**Course Outcomes:** After studying this course, students will be able to:

1. Appreciate the technologies related to Micro Electro Mechanical Systems.
2. Understand design and fabrication processes involved with MEMS Devices.
3. Analyze the MEMS devices and develop suitable mathematical models.
4. Know various application areas for MEMS device.
5. Describe the Micromanufacturing.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Book:**

- Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.

**Reference Books:**

1. Hans H. Gatzen,Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.
2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cengage Learning.

# RADAR ENGINEERING

| | | | |
|---|---|---|---|
| Course Code | : 18EC823 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Understand the Radar fundamentals and analyze the radar signals.
- Understand various technologies involved inthe designo fradar transmitters and receivers.
- Learn various radars like MTI, Doppler and tracking radars and their comparison

**Module-1**

**Basics of Radar:** Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse wave form-PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems.

**(Chapter 1 of Text)** **L1, L2,L3**

**Module-2**

**The Radar Equation**: Prediction of Range 'Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector - False Alarm Time and Probability, Probability of Detection, Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

**(Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)** **L1,L2,L3**

**Module-3**

**MTI and Pulse Doppler Radar:** Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with– Power Amplifier Transmitter, Delay Line Cancelers— Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler, Digital MTI Processing–Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD.

**(Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)** **L1,L2,L3**

**Module-4**

**Tracking Radar:**Tracking with Radar- Types of Tracking Radar Systems,

Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse.
Sequential Lobing, Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range, Comparison of Trackers.
**(Chapter4: 4.1, 4.2, 4.3 of Text)**, **L1,L2,L3**

## Module-5

**The Radar Antenna :** Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phase darray Antennas. (Chapter 9:9.1,9.29.4, 9.5 of Text)
**Radar Receiver:** The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. **(Chapter 11 of Text)**, **L1, L2,L3**

**Course Outcomes**: At the end of the course, students will be able to:

1. Describe the radar fundamentals.
2. Analyze the radar signals.
3. Explain the working principle of pulse Doppler radars, their applications and limitations.
4. Describe the working of various radar transmitters and receivers.
5. Analyze the range parameters of pulse radar system which affect the system performance.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**TEXT BOOK:**

Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001

**REFERENCE BOOKS:**

1. Radar Principles, Technology, Applications—ByronEdde, Pearson Education, 2004.
2. Radar Principles–Peebles. Jr, P.Z. Wiley. New York, 1998.
3. Principles of Modem Radar: Basic Principles–Mark A. Rkhards, James A. Scheer, William A. HoIm. Yesdee, 2013

# OPTICAL COMMUNICATION NETWORKS

| | | | |
|---|---|---|---|
| Course Code | : 18EC824 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (08 Hrs / Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:** This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Learn the network standards in optical fiber and understand the network architectures along with its functionalities.

**Module -1**

**Optical fiber Communications:** Historical development, The general system, Advantages of optical fiber communication, Optical fiber wave guides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers.

**(Text 2)** **L1, L2**

**Module -2**

**Transmission characteristics of optical fiber**: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.

**Optical Fiber Connectors:** Fiber alignment and joint loss, Fiber splices: Fusion Splices, Mechanical splices, Fiber connectors: Cylindrical ferrule connectors, Duplex and Multiple fiber connectors, Fiber couplers: three and four port couplers, star couplers, Optical Isolators and Circulators.

**(Text 2)** **L1, L2**

**Module -3**

**Optical sources:** Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant Frequencies.

**Photodetectors**: Physical principles of Photodiodes, Photo detector noise, Detector response time.

**Optical Receiver:** Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit.
**(Text1)**

**L1, L2**

**Module -4**

**WDM Concepts and Components**: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings. Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers.
**(Text 1)** **L1, L2**

**Module -5**

**Optical Networks :** Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks.
**(Text 2)** **L1, L2**

**Course Outcomes:** At the end of the course, students will be able to:

1. Classify and describe working of optical fiber with different modes of signal propagation.
2. Describe the transmission characteristics and losses in optical fiber communication.
3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4. Describe the constructional features and the characteristics of optical Sources and detectors.
5. Illustrate the networking aspects of optical fiber and describe various standards associated with it.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.

- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. Gerd Keiser, Optical Fiber Communication, 5th Edition, Mc Graw Hill Education (India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

**Reference Book:**

- Joseph C Palais, Fiber Optic Communication, Pearson Education, 2005, ISBN:0130085103.

# BIOMEDICAL SIGNAL PROCESSING

| | | | |
|---|---|---|---|
| Course Code | : 18EC825 | CIE Marks | : 40 |
| Lecture Hours/Week | : 03 | SEE Marks | : 60 |
| Total Number of Lecture Hours | : 40 (8 Hrs /Module) | Exam Hours | : 03 |
| CREDITS – 03 | | | |

**Course Learning Objectives:**
This course will enable students to:

- Describe the origin, properties and suitable models of important biological signals such as ECG and EEG.
- Know the basic signal processing techniques in analysing biological signals.
- Acquire mathematical and computational skills relevant to the field of biomedical signal processing.
- Describe the basics of ECG signal compression algorithms.
- Know the complexity of various biological phenomena.
- Understand the promises, challenges of the biomedical engineering.

**Module -1**

**Introduction to Biomedical Signals:** The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis.
**Electrocardiography:** Basic electrocardiography, ECG leads systems, ECG signal characteristics.
**Signal Conversion** :Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits
**(Text-1)** **L1,L2**

**Module -2**

**Signal Averaging:** Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging.
**Adaptive Noise Cancelling:** Principal noise canceller model, 60-Hz adaptive cancelling using a sine wave model, other applications of adaptive filtering
**(Text-1)** **L1,L2,L3**

**Module -3**

**Data Compression Techniques:** Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG **(Text-1)** **L1,L2, L3**

## Module -4

**Cardiological signal processing:**

Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Real-time ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor.

**(Text -2)** **L1,L2, L3**

## Module -5

**Neurological signal processing:** The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation.

**Analysis of EEG channels:** Detection of EEG rhythms, Template matching for EEG, spike and wave detection

**(Text-2)**

**L1,L2, L3**

**Course Outcomes:** At the end of the course, students will be able to:

1. Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG signals.
2. Apply classical and modern filtering and compression techniques for ECG and EEG signals.
3. Develop a thorough understanding on basics of ECG and EEG feature extraction.
4. Evaluate various event detection techniques for the analysis of the EEG and ECG
5. Develop algorithms to process and analyze biomedical signals for better diagnosis.

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**Text Books:**

1. **Biomedical Digital Signal Processing-** Willis J. Tompkins, PHI 2001.
2. **Biomedical Signal Processing Principles and Techniques-** D C Reddy, McGraw- Hill publications 2005.

**Reference Book:**

- **Biomedical Signal Analysis-**Rangaraj M. Rangayyan, John Wiley & Sons 2002.

# Scheme of Teaching and Evaluation for B.E III & IV Semester

## ELECTRONICS & COMMUNICATION ENGG.

## (2022 Scheme)

# B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2022
## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
## (Effective from the academic year 2023-24)

## III SEMESTER

| SN | Course | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | SDA | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22BB31 | Biology for Engineers | CHEM | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22EC32 | Digital Circuit Design using Verilog | EC | 2 | 2 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22EC33 | Network Analysis | EC | 2 | 2 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22EC34 | Analog Electronic Circuits | EC | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22ECL35 | Analog Electronic Circuits Laboratory | EC | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22EC361 | ESC/ETC/PLC | EC | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22SC37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC/ SEC | 22EC381 | Ability Enhancement Course/Skill Enhancement Course - III Department specific ability enhancement course | EC | If the course is a Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If a course is a laboratory | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| Total | | | | | | | | | | 550 | 350 | 900 | 20 |

| Engineering Science Course (ESC/ETC/PLC) | |
|---|---|
| 22EC361 | Computer Organization and Architecture |
| Ability Enhancement Course – III | |
| 22EC381 | Programming with Hardware Controllers |

## ADDITIONAL MATHEMATICS for Lateral Entry Students

| SN | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self -Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | L | T | P | S | | | | | |
| 1 | 22MATDIP31 | ADDITIONAL MATHEMATICS-I | MATHS | 3 | 0 | 0 | | 03 | 100 | 00 | 100 | 0 |

# IV SEMESTER

| SN | Course and Course Code | | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week: Theory Lecture | Tutorial | Practical/ Drawing | Self -Study | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | S | | | | | |
| 1 | BSC | 22MEE41 | Applied Mathematics for Electrical and Electronics Engineering | MATHS | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22EC42 | Engineering Electromagnetics | XX | 2 | 2 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22EC43 | Control Systems | | 2 | 2 | 2 | | | | | | 4 |
| 4 | PCC | 22EC44 | Communication Systems- I | XX | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22ECL45 | Communication Laboratory-I | XX | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22EC46x | ESC/ETC/PLC | XX | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | AEC/ SEC | 22PSW47 | Professional Skills for the Work Place | HS | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 8 | UHV | 22UH48 | Universal human values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | 22NS49 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE49 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO49 | Yoga | Yoga Teacher | | | | | | | | | |
| **Total** | | | | | | | | | | **500** | **400** | **900** | **20** |

| Ability Enhancement Course / Skill Enhancement Course - IV | | | |
|---|---|---|---|
| **22PSW47** | **Professional Skills for the Work Place** | | |
| **Engineering Science Course (ESC/ETC/PLC)** | | | |
| **22EC461** | **8051 Microcontroller** | **22EC462** | **Oops using C++** |

## ADDITIONAL MATHEMATICS for Lateral Entry Students

| SN | Course Code | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week: Theory Lecture | Tutorial | Practical/ Drawing | Self -Study | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | S | | | | | |
| 1 | **22MATDIP41** | **ADDITIONAL MATHEMATICS-II** | MATHS | 3 | 0 | 0 | | 03 | 100 | 00 | 100 | 0 |

**Semester: III**
**BIOLOGY FOR ENGINEERS**

| | | | |
|---|---|---|---|
| Course Code | **22BB31** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P: S) | **3:0:0:** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **3** |
| Examination type (SEE) | **Theory** | | |

**Course objectives:**
- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning / inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical / hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR / VR / MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical / hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) / oral presentations.

**Module-1** **08 Hours**

**INTRODUCTION TO BIOLOGY:**
The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

**Module-2** **08 Hours**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):**
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents / detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

**Module-3** **08 Hours**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):**
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

**Module-4** **08 Hours**

**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):**
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

**Module-5** **08 Hours**

**TRENDS IN BIOENGINEERING (QUALITATIVE):**
Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

**Course outcome (Course Skill Set)**
At the end of the course, the student will be able to :
1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

**Suggested Learning Resources:**
**Books**
- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

**Web links and Video Lectures (e-Resources):**

- https: / / nptel.ac.in / courses / 121106008
- https: / / freevideolectures.com / course / 4877 / nptel-biology-engineers-other-non-biologists
- https: / / ocw.mit.edu / courses / 20-020-introduction-to-biological-engineering-design-spring-2009
- https: / / ocw.mit.edu / courses / 20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https: / / www.coursera.org / courses?query=biology
- https: / / onlinecourses.nptel.ac.in / noc19_ge31 / preview
- https: / / www.classcentral.com / subject / biology
- https: / / www.futurelearn.com / courses / biology-basic-concepts

**Activity Based Learning (Suggested Activities in Class) / Practical Based learning**

- Group Discussion of Case studies
- Model Making and seminar / poster presentations
    - Design of novel device / equipment like Cellulose-based water filters, Filtration system

**III Semester**
**Course Name: Digital Circuit Design Using Verilog**

| | | | |
|---|---|---|---|
| Course Code | **22EC32** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40(T)+20(P)** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
Number systems, Arithmetic and Logical operations, Basic gates.
**Course objectives:**
1. To prepare learners with fundamental knowledge/ overview in the field of Digital system Design & its programming language.
2. To equip learners with a basic foundation in VLSI design fundamentals required for comprehending the operation and application of digital design and embedded systems.
3. To inculcate in second-year engineering learners an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.
4. To facilitate learners to experience task-based learning, peer learning and enable learners to inculcate self-study culture.

**Module – 1** **08 Hours**

**Principles of Combinational Logic:** Definition of combinational logic, Problem statements to truth tables, Deriving switching equations, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps, Three and four variables Karnaugh maps, Incompletely specified Functions (Don't care Terms), Simplifying Maxterm Equations, Map entered variables, Multiple output functions.
**Text1:**3.1, 3.1.1, 3.1.2, 3.2, 3.3, 3.4, 3.4.1, 3.4.5, 3.4.6, 3.6 & 3.8

**Self-study topics:**

Hazards in combinational circuits, Quine-McCluskey Minimization Technique, Quine–McCluskey using Don't Care Terms.

**Module - 2** **06 Hours**

**Overview of digital design with Verilog HDL:** Typical HDL flow, Importance of HDLs.
**Hierarchical Modeling concepts:** Design methodologies, Modules.
**Verilog basic concepts:** Lexical conventions, data types.
**Modules and ports:** Module definition, port declaration, port connection rules.
**Gate level modeling:** Gate types, AND/OR gates, BUF/NOT gates, Examples like 4-bit ripple carry full adder.
**Text 2:** 1.3, 1.4, 2.1, 2.3, 3.1, 3.2, 4.1, 4.2.2, 4.2.3, 5.1, 5.1.1, 5.1.2, 5.1.4

**Self-study topics:**

Popularity of Verilog HDL, Components of a simulation, Half Adder & full adder using gate level modeling.

**Module – 3** **08 Hours**

| |
|---|
| **Analysis and Design of Combinational Logic:** Introduction to Digital Integrated circuits, Decoders, BCD Decoder, Encoders, Digital Multiplexers, Using multiplexer as Boolean Function generators, Adders and Subtractors, Cascading full adders, Look ahead carry, Binary Comparator (1 bit, 2-bit comparators only), Tri-state buffers.<br>**Text1:**4.2, 4.3,4.3.1, 4.4,4.5,4.5.1, 4.6, 4.6.1, 4.6.2,4.7,4.10 |
| **Self-study topics:** |
| Adders types, role of decoder in processor, ALU and Array Multipliers. |

**Module – 4** **10 Hours**

| |
|---|
| **Sequential circuits:** Sequential circuit models (universal model only), Flip-flops: flip-flop logic symbols, function and triggering, Latches, J-K Clocked flip-flops, clocked T&D flip-flop, Master- slave flip-flops, Edge triggered flip-flops, Flip Flop timing specifications.<br>**Simple counters:** Divide by 2, 4, and 8 counters (Asynchronous), Mod-8 synchronous counter. Registers: Register Data input and output, Parallel input/Parallel output, Serial input/serial output shift registers.<br>**Finite State Machines:** Mealy sequential circuit design, Design of Moore sequential Circuit, Equivalent States and Reduction of State Tables.<br>**Text1:** 5.1, 5.2, 5.3, 5.4, 5.6, 5.6.1,6.1,6.2 ,6.2.1 ,6.2.2, 6.5<br>Text3:1.7, 1.8, 1.9 |
| **Self-study topics:** |
| Johnson counter (Synchronous), Ring counter (synchronous), Up-Down Decade counter design, Difference between Moore and Mealy models, |

**Module – 5** **08 Hours**

| |
|---|
| **Data flow modeling:** Expressions, Operators and operands, operator types, Examples such as 4to1 multiplexer, 4-bit full adder.<br>**Behavioral modeling:** Structured procedures, Procedural assignments, Delay based timing control, Multiway branching , loops, Examples -Only Verilog Description<br>**Text 2:** 6.3, 6.4, 6.5, 6.5.1, 6.5.2, 7.1,7.2,7.3.1, 7.5,7.6,7.9. |
| **Self-study topics:** |
| Logic synthesis with Verilog |

## PRACTICAL COMPONENT OF IPCC

| SN | Experiments |
|---|---|
| | **Part A** |
| The following experiments can be done using Digital IC Trainer Kit | |
| 1 | To verify<br>i. The SOP and POS expressions using universal gates.<br>ii. De- Morgan's theorem for 2 variables. |
| 2 | Design and implement<br>i. Half adder and Full adder<br>ii. Half subtractor Full subtractor<br>iii. 4-bit parallel adder using IC7483 (Optional) |
| 3 | Design and implement<br>i. Simplified 4 variable function using basic gates by applying Boolean rules and K- map.<br>ii. 4 variable function using IC74151(8:1MUX). |
| 4 | Realize<br>i. SR Flip Flop<br>ii. D Flip Flop<br>iii. Master and slave JK Flip Flop<br>iv. T Flip Flop |
| 5 | i. Realize shift register using IC 7495.<br>a. SISO<br>b. SIPO<br>c. PISO<br>d. PIPO<br>ii. Realize Mod-n synchronous counter using IC74192.<br>iii. Realize Mod-n asynchronous counter using IC7490. |
| | **Part B** |
| **The following experiments can be done using Xilinx/ Mentor Graphics or any other equivalent EDA tools** | |
| 1 | Write a Verilog code to describe the functions of a Full Adder using three modeling styles |
| 2 | Write a Verilog Code to<br>i. Design 8:3 Encoders with and without Priority.<br>ii. Design 2:1 Multiplexer using Conditional Operator. |
| 3 | Design a Mod-n counters (Synchronous reset and Asynchronous reset) using Verilog code. |
| 4 | Any other additional experiments can be done based up on the needs and requirements. |

**Course Outcomes:**

1. **Use** Karnaugh map and Quine-McCluskey minimization methods to simplify the given digital circuits.
2. **Explore** the applications of combinational logic circuits such as Decoder, Encoder, Multiplexer, Adder, Subtractor etc., to realize the given Boolean function.
3. **Explore** the applications of sequential logic circuits and their machine models to design digital circuits.
4. **Realize** the given digital circuits using structural, data flow and behavioral Verilog HDL modeling styles with appropriate design approaches.
5. **Conduct** Open-Ended Experiments/Mini lab projects related to applications of Digital Circuits and propose innovative solutions.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Logic Applications and Design. | John M Yarbrough | Cengage Learning | 2008 (reprint) |
| 2 | Verilog HDL: A Guide to Digital Design and Synthesis. | Samir Palnitkar | Pearson Education | 2nd Edition |
| 3 | Fundamentals of Logic Design. | Charles H. Roth (Jr.) | West publications | 4th Edition, 1992 |
| **Reference Books** | | | | |
| 1 | Modern Digital Electronics | R P Jain | Tata McGraw-Hill. | Third Edition |
| 2 | Digital Principle and Design. | Donald D. Givone | McGraw-Hill | 2003 |
| 3 | HDL Programming VHDL and Verilog | Nazeih M Botros | Dreamtech press | 2009 |

**Semester III**
**Course Name: Network Analysis**

| | | | |
|---|---|---|---|
| Course Code | **22EC33** | CIE Marks | **50** |
| Teaching Hours/Week (L: T:P) | **2:2:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40(T)+20(P)** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:** Students need a foundation in electrical engineering and circuit theory. Understanding concepts like Ohm's law, Kirchhoff's laws, capacitance, inductance, and impedance is essential. Proficiency in analyzing both AC and DC circuits, as well as knowledge of various circuit components like resistors, capacitors, and inductors will be crucial.

**Course objectives:**
By the end of this course, students will be able to:
1. **Master Foundational Concepts:** Develop a thorough understanding of fundamental principles, network elements, and circuit laws that govern the behavior of electrical networks.
2. **Apply Network Theorems:** Effectively apply a variety of network theorems, such as Thevenin's theorem, Norton's theorem, and Superposition theorem, to simplify complex circuits and analyze their behavior.
3. **Analyze in the Frequency Domain:** Gain proficiency in using Laplace Transformation to analyze network responses in the frequency domain, allowing for a comprehensive understanding of system behavior over time.
4. **Predict Transient Behaviors:** Comprehend transient responses of networks and analyze their behavior during the initial conditions, enabling accurate predictions of circuit behavior during start-up and transients.
5. **Explore Resonant Circuits:** Understand the behavior of resonant circuits, including their applications in filters and oscillators, and how to design and analyze such circuits for specific frequency responses.
6. **Characterize Two-port Networks:** Learn how to determine and interpret two-port network parameters, such as impedance, admittance, and transmission parameters, which are crucial in understanding and designing complex interconnected systems.
7. **Hands-on Simulink Experience:** Gain practical experience through hands-on experiments using Simulink, a powerful simulation tool, to reinforce theoretical concepts and enhance analytical skills.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| Basic Concepts: Introduction, Practical sources, Source transformations, Network reduction using Star–Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. |

**Module - 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| Network Theorems: Introduction, Superposition theorem, Reciprocity theorem, Millman‘s theorem, Thevenin‘s theorem, Norton‘s theorem, proof of thevenin’s and Norton’s theorem Maximum Power transfer theorem. |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| Laplace Transformation & Applications: Introduction, Laplace transform of standard input signals, properties of Laplace transform, initial and final value theorem, Solution of networks, step, ramp and impulse responses, waveform Synthesis.<br>Transient behavior and initial conditions: Introduction, Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| Resonant Circuits: Introduction, Transfer functions, Series Resonance- Band width, Quality factor and half power frequencies. Parallel resonance-transfer function and frequency-response, resonance in a two branch RL-RC parallel circuits, practical parallel and series resonant circuits. |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| Two port network parameters: Introduction, Admittance parameters, Impedance parameters, z and y parameters by matrix partition, Hybrid parameters, transmission parameters, modeling with these parameters, relationship between two- port parameters. |

**PRACTICAL COMPONENT OF IPCC**

| SN | List of Experiments |
|---|---|
| 1 | Introduction to MATLAB |
| 2 | Verification of Mesh Analysis or loop Analysis for DC excitation using MATLAB simulink digital simulation |
| 3 | verification of Nodal Analysis for DC excitation using MATLAB simulink digital simulation |
| 4 | Verification of Superposition theorem DC excitation using MATLAB simulink digital simulation |
| 5 | Verification of Thevenin’s theorem DC excitation using MATLAB simulink digital simulation |
| 6 | Verification of Norton’s Theorem DC excitation using MATLAB simulink digital simulation |
| 7 | To obtain the plot of of frequency vs. XL, frequency vs. XC , frequency vs. impedance and frequency vs. current for the given series RLC circuit and determine the resonant frequency and check by theoretical calculations |
| 8 | Write a MATLAB program to generate step and ramp input for 1$^{st}$ order systems |

**Course Outcomes:**

1. Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/ source transformation/ source shifting.
2. Solve network problems by applying electrical laws to reduce circuit complexities and to arrive at feasible solutions.
3. Apply Laplace transform to solve the given network. Calculate current and voltages for the given circuit under transient conditions.
4. Evaluate for RLC elements in resonant circuits and solve the given network using specified two port network parameter like Z or Y or T or h.
5. Conduct Open-Ended Experiments/Mini lab projects related to electrical circuits and propose suitable solutions.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Network analysis | M.E. Van Valkenberg (2000) | Prentice Hall of India | 3rd edition, 2000, ISBN: 9780136110958. |
| 2 | Networks and systems | Roy Choudhury | New Age International Publications | 2006, ISBN: 9788122427677 |
| **Reference Books** | | | | |
| 1 | Engineering Circuit Analysis | Hayt, Kemmerly and Durbin | TMH | 7th Edition, 2010 |
| 2 | Basic Engineering Circuit Analysis | J. David Irwin /R. Mark Nelms | John Wiley, | 8thed, 2006. |
| 3 | Fundamentals of Electric Circuits | Charles K Alexander and Mathew N O Sadiku | Tata McGraw-Hill | 3rd Ed, 2009 |

**e-Resources:**
1. https://nptel.ac.in/courses/108106098
2. https://nptel.ac.in/courses/108102042

**Semester: III**
**Course Name: Analog Electronic Circuits**

| | | | |
|---|---|---|---|
| Course Code | **22EC34** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
Semiconductor Physics, Electronic Devices

**Course objectives:**
This course will enable students to:
1. Explain basic Operation and characteristics of Diodes, BJT, FET parameters, connections and configurations.
2. Design various types of BJT and FET biasing for amplifier circuits
3. Understand the fundamentals of feedback structure and basic feedback topologies
4. Analyze Power amplifier circuits in different modes of operation
5. Discuss the working principle of data converters using Op-Amp
6. Design first and second order Butterworth Active filters using Op-Amp
7. Explain the working of Monostable and Astable multivibrators using IC 555 timer

**Module – 1** **08 Hours**

**Introduction to Electronic Devices**
**Diode & its applications:** Introduction, PN-Junction Diode, Equivalent Circuit of Diode, Half Wave & Full Wave Rectification (With Derivation of Efficiency & Ripple Factor), Wave Shaping Circuits-Clipping, Clamping
**Voltage Regulators:** Fixed Voltage Regulators and Adjustable Voltage Regulators
**BJT:** Introduction, BJT Construction and Operation, BJT Configuration and characteristics
**FET:** Introduction to FET, Construction, operation, Characteristics of MOSFET
**(Text 1: 2.1,2.2,2.2.3,2.4,2.5.1,2.5.2,2.5.4,2.5.5, 3.1,3.2,3.3, 4.1,4.3 Text 3: 9.7.1,9.7.2)**

**Self-Study Topics:**
BJT as Switch & as Amplifier

**Module – 2** **08 Hours**

**BJT Biasing:** Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage- divider bias), Biasing using a collector to base feedback resistor.
**BJT Small signal operation and Modeling:** Collector current and transconductance, Base current and input resistance at the base, Emitter current and input resistance at the emitter, voltage gain, Separating the signal and the DC quantities, The hybrid Π model, The T model.
**MOSFETs Biasing:** Biasing in MOS amplifier circuits: Biasing by Fixing $V_{GS}$, Biasing by Fixing $V_G$ and Biasing using a Drain to Gate feedback resistor.
**MOSFET Small signal operation and Modeling:** The DC bias point, signal current in drain terminal, voltage gain, Separating the DC Analysis and the signal analysis, small signal equivalent circuit models, Transconductance, The T equivalent circuit model.
(Text 2: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.7), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.7))

**Self-Study Topics:**
Large Signal Modeling for BJT

**Module – 3** **08 Hours**

| |
|---|
| **MOSFET Amplifier configuration:** Basic Structure, characterizing amplifiers, CS amplifier with and without source resistance RS, Source follower amplifier.<br>**MOSFET internal capacitances and High frequency model:** The gate capacitive effect, Junction capacitances, High frequency MOSFET model.<br>**Frequency response of the CS amplifier:** The three frequency bands, high frequency response, Low frequency response.<br>**IC Biasing:** Current Sources, Current Mirrors and Current Steering Circuits.<br>(Text 2: 4.7 (4.7.1 to 4.7.4, 4.7.6), 4.8(4.8.1, 4.8.2, 4.8.3), 4.9(4.9.1,4.9.2,4.9.3), 6.3(6.3.1,6.3.2)) |
| **Self-Study Topics:** |
| Large Signal Modeling for MOSFET |

**Module – 4** **08 Hours**

| |
|---|
| **Feedback Amplifier:** General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt Feedback amplifier, series-series Feedback amplifier, shunt-shunt and shunt-series Feedback amplifiers (Qualitative Analysis).<br>**Power Amplifiers:** Introduction, Classification of output stages, Class A and Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage: Circuit operation, output resistance, Class C Output Stage: Efficiency.<br>**(Text** 2:7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 12.1, 12.2 (12.2.1,12.2.3,12.2.4), 12.3 (12.3.2,12.3.3, 12.3.4), 12.4,12.6) |
| **Self-Study Topics:** |
| Class D Power Amplifier |

**Module – 5** **08 Hours**

| |
|---|
| **Op-Amp Applications:** Instrumentation Amplifier, Peak detector, DAC-Weighted resistor and R- 2R ladder, ADC- Successive approximation type, Active Filters- First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters.<br>**IC 555 Timers and its Operating modes:** Introduction, Monostable and Astable Multivibrators.<br>**(Text 3:** 6.6, 8.11(8.11.1(a), 8.11.1(b), 8.11.2(a), 8.14, 7.2-7.6, 7.8, 7.9, 9.4) |
| **Self-Study Topics:** |
| Waveform generators using 555 Timer. |

**Course Outcomes:**
After studying this course, students will be able to:
1. **Outline** the Construction, operation & characteristics of Junction & Field Effect devices
2. **Design and analyze** BJT and FET amplifiers with different circuit configurations and biasing conditions.
3. **Apply** the concepts of feedback topologies in the design of amplifiers and oscillators.
4. **Explore** the wide range applications of linear ICs such as ADC, DAC, filters and timers.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Basic Electronics | D.P Kothari & I J Nagrath | McGraw Hill Education (India) Pvt. Limited, | 2014,ISBN: 978-93-329-0158-2, |
| 2 | "Micro Electronic Circuits Theory and Application" | Adel S. Sedra and Kenneth C. Smith, | Oxford University Press | 5th Edition , 2013, ISBN-10:978-0- 19-806225-7 |
| 3 | "Op-Amps and Linear Integrated Circuits" | Ramakant A Gayakwad | Pearson Education | 4th Edition, 2018. ISBN: 978-93-325-4991-3 |
| **Reference Books** | | | | |
| 1 | "Electronics devices and Circuit theory" | Robert L. Boylestad and Louis Nashelsky | Pearson Education | 10th/11th Edition, 2012, ISBN:978-81-317-6459-6. |
| 2 | "Integrated Electronics Analog and Digital Circuits and Systems" | J.Millman & C.C.Halkias | McGraw Hill Education (India) Pvt. Limited, | 2nd edition, 2010, ISBN 0- 07-462245-5 |

**III Semester**
**Name of the Laboratory: Analog Electronic Circuits Laboratory**

| | | | |
|---|---|---|---|
| Course Code | **22ECL35** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Pre-requisites:** Semiconductor Physics, Electronic Devices

**Course Objectives:**
This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:

- Rectifiers and Voltage Regulators
- BJT Amplifier characteristics
- MOSFET Characteristics and Current Mirrors
- Op-amp and 555 Applications

**List of Experiments:**

| SN | Part-A Experiments using Discrete components |
|---|---|
| 1 | Design and set up the following rectifiers with and without filters and determine ripple factor and efficiency: (a)Full Wave Rectifier (b) Bridge Rectifier |
| 2 | Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative) for given specifications. |
| 3 | Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response |
| 4 | Design and set-up the crystal oscillator and determine the frequency of oscillation. |
| 5 | Design Adder, Integrator and Differentiator circuits using Op-Amp |
| 6 | Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis |
| 7 | Design Astable Multivibrator using 555 Timer for given specifications |
| 8 | Design 4-bit R-2R DAC using Op-Amp |
| | **Part-B Simulation using EDA software (p-spice, Multisim or any Equivalent tool)** |
| 1 | Design and Simulate the RC-Phase shift Oscillator using Op-Amp, and Verify the frequency of Oscillations |
| 2 | Design and Simulate the Monostable Multivibrator using 555 Timer for given specifications |
| 3 | Simulate the transfer and drain characteristics of a MOSFET and calculate its drain resistance, mutual conductance and amplification factor |
| 4 | Simulate Current Mirror Circuits using MOSFET |
| 5 | Part-C Open-Ended Experiments / Mini Lab Projects |
| | Any Open-Ended Experiments / Mini Lab Projects |

**Course Outcomes:**

At the end of this laboratory course, the students will be able to:

1. **Implement** circuits of rectifiers, clipping circuits, clamping circuits for a given specifications
2. **Analyze** the characteristics of BJT/MOSFET in the design of amplifiers and current mirrors
3. **Design** analog circuits using OPAMPs and 555 timer for different applications
4. **Demonstrate** the solutions for the given open-ended problem/ Mini lab projects applying Analog circuit design principles

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| 1. | "Basic Electronics" | D.P Kothari & I J Nagrath | McGraw Hill Education (India) Pvt. Limited, | 2014,ISBN: 978-93-329-0158-2, |
| 2 | "Micro Electronic Circuits Theory and Application" | Adel S. Sedra and Kenneth C. Smith, | Oxford University Press | 5th Edition , 2013, ISBN-10:978-0-19- 806225-7 |
| 3 | "Op-Amps and Linear Integrated Circuits" | Ramakant A Gayakwad | Pearson Education | 4th Edition,2018. ISBN: 978-93-325-4991-3 |

**Reference Books:**

"Electronics Lab Manual", Navas K A, PHI Learning Pvt. Ltd., 2018

**Semester: III**
**Course Name: Computer Organization and Architecture**

| | | | |
|---|---|---|---|
| Course Code | **22EC361** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
Fundamentals of digital logic.
**Course objectives:**
This course will enable students to:
1. Explain the basic sub systems of a computer, their organization, structure and operation.
2. Illustrate the concept of programs as sequences of machine instructions.
3. Demonstrate different ways of communicating with I/O devices
4. Describe memory hierarchy and concept of virtual memory.
5. Illustrate organization of simple pipelined processor and other computing systems.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Basic Structure of Computers:** Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation (upto 1.6.2 of Chap 1 of Text). **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing (upto 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Problem Solving. |

**Module - 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Addressing Modes:** Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions (from 2.4.7 of Chap 2, except 2.9.3, 2.11 & 2.12 of Text) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Hands-on Coding through compilation. |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Input / Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct |
| Memory Access (upto 4.2.4 and 4.4 except 4.4.1 of Chap 4 of Text). |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs. |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Memory System:** Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks (5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 of Chap 5 of Text). |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Visual Aids. |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control (upto 7.5 except 7.5.1 to 7.5.6 of Chap 7 of Text).<br>Case Study on Intel Core i-7 architecture. |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs. |

**Course Outcomes:**

1. Demonstrate the understanding of the basic organization of a computer system.
2. Explore the architectures of various microprocessors, instruction sets and assembly programing.
3. Analyze different ways of accessing an input / output device including interrupts.
4. Illustrate the organization of different types of semiconductor and other secondary storage memories.
5. Illustrate simple processor organization based on hardwired control and micro programmed control.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks:** | | | | |
| 1 | Computer Organization | Carl Hamacher, Zvonko Vranesic, Safwat Zaky | Tata McGraw Hill | 5th Edition, 2002. |
| **Reference Books:** | | | | |
| 1 | Computer Organization and Design – The Hardware / Software Interface ARM Edition | David A. Patterson, John L. Hennessy | Elsevier | 4th Edition, 2009. |
| 2 | Computer Organization & Architecture | William Stallings | PHI | 7th Edition, 2006. |
| 3 | Computer Systems Design and Architecture | Vincent P. Heuring & Harry F. Jordan | Pearson Education | 2nd Edition, 2004. |

**E-Resources:**

https://onlinecourses.nptel.ac.in/noc22_cs88/preview
https://archive.nptel.ac.in/courses/106/105/106105163/

**Semester: III**
**SOCIAL CONNECT & RESPONSIBILITY**

| | | | |
|---|---|---|---|
| Course Code | **22SC37** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P: S) | **0:0:3:1** | SEE Marks | **--** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (No SEE – Only CIE) | **For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept. / Any Dept.** | | |
| Credits | **01 – Credit** | | |

**Course objectives:**
The course will enable the students to:
1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Contents:**
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

**In the following a set of activities planned for the course have been listed:**

| Contents |
|---|
| **Part I:**<br>**Plantation and adoption of a tree:**<br>Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. |
| **Part II :**<br>**Heritage walk and crafts corner:**<br>Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes. |
| **Part III :**<br>**Organic farming and waste management:**<br>Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – |
| **Objectives, Visit, Case Study, Report, Outcomes.**<br>**Part IV:**<br>**Water conservation:**<br>Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes. |

| |
|---|
| **Part V :**<br>**Food walk:**<br>City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes. |

**Course outcomes (Course Skill Set):**

At the end of the course, the student will be able to:

CO1: Communicate and connect to the surrounding.
CO2: Create a responsible connection with the society.
CO3: Involve in the community in general in which they work.
CO4: Notice the needs and problems of the community and involve them in problem –solving.
CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Activities:**

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**PEDAGOGY:**

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs / social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

**COURSE TOPICS:**

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

**DURATION:**

A total of 40 - 50 hours engagement per semester is required for the 3rd semester of the B.E. / B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

**Guideline for Assessment Process:**

**Continuous Internal Evaluation (CIE):**

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor / s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and / or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

**Excellent:** **80 to 100**
**Good:** **60 to 79**
**Satisfactory:** **40 to 59 Unsatisfactory and fail : <39**

**Special Note:**

**NO SEE – Semester End Exam – Completely Practical and activities based evaluation**

**Pedagogy – Guidelines:**

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

| SN | Topic | Group size | Location | Activity Execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Plantation and adoption of a tree: | May be individual or team | Farmers land / parks / Villages / roadside / community area / College campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 2. | Heritage walk and crafts corner: | May be individual or team | Temples / monumental places / Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 3. | Organic farming and waste management: | May be individual or team | Farmers land / parks / Villages visits / roadside / community area / College campus etc. | Group Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 4. | Water conservation: & conservation techniques | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 5. | Food walk: Practices in society | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Group Selection / Proper Consultation A/ Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |

**Plan of Action (Execution of Activities)**

| SN | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study based Assessment, Individual performance |
| 9 | Sector / Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities, compiled report should be submitted as per the instructions and scheme.

**III Semester**

**Name of the Course: Programming with Hardware Controllers**

| | | | |
|---|---|---|---|
| Course Code | **22EC381** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **02** |

**Pre-requisites:** Basic Electronics and fundamentals of C programming.

**List of Experiments:**

| **Part A: Basic Arduino Programming** | |
|---|---|
| SN | Experiments |
| 1 | Getting Started with Arduino: Arduino platform, Prototyping environment |
| 2 | Arduino IDE: Arduino Development Environment, setting up the Arduino board with Electronic components and connections. |
| 3 | Arduino First Program: Creating sketches, using Libraries, using example codes, Debugging Using the Serial Monitor. |
| 4 | Arduino Interfaces- Different Sensors & Actuators |
| **Part B: Basic Raspberry Pi Programming** | |
| 1 | Getting Started with Raspberry Pi Basic functionality of the Raspberry Pi board and its Processor, setting and configuring the board |
| 2 | Introduction to Linux: Overview of Linux and its terminal Commands for operating Raspberry Pi |
| 3 | Programming the Raspberry Pi: Python - Introducing to Python programming language & Python Programming Environment |
| 4 | Exploring Electronics with the Raspberry Pi: Sensors & Actuator Interfacing |
| **Part C: Open Ended Experiments/Mini-Project (Only for CIE, not for SEE)** | |
| A Mini-project using Arduino/Raspberry Pi | |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Create sketches, libraries inside the Arduino Development Environment.
2. Wire Raspberry Pi and create a fully functional computer.
3. Use Python-based IDE, trace and debug Python code on Raspberry Pi.
4. Interface suitable sensors and actuators with Arduino/Raspberry Pi to measure and control physical world.
5. Implement the solution using arduino/raspberry pi for a given open ended problem.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Arduino Cookbook | Michael Margolis, | O'Reilly Media | 1st edition. |
| 2 | Raspberry Pi Cookbook for Python Programmers | Tim Cox | Packt Publishing Ltd. | 2nd Revised edition, 2016 |
| **Reference Books** | | | | |
| 1 | Arduino for beginners : Essential Skills Every Maker Needs | John Baichtal | Pearson Education, Inc | 1st edition,2013 |
| 2 | Raspberry Pi User Guide | Eben Ubton and Gareth Halfacree | John Wiley Publications | 4th Edition.2016 |

**Semester: III**

**PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I**

| | | | |
|---|---|---|---|
| Course Code | **22PE39** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:1** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional / state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

**Module I: Orientation** **05 Hours**

a. Lifestyle
b. Fitness
c. Food & Nutrition
d. Health & Wellness
e. Pre-Fitness test.

**Module II: General Fitness & Components of Fitness** **15 Hours**

a. Warming up (Free Hand exercises)
b. Strength – Push-up / Pull-ups
c. Speed – 30 Mtr Dash
d. Agility – Shuttle Run
e. Flexibility – Sit and Reach
f. Cardiovascular Endurance – Harvard step Test

**Module III: Recreational Activities** **10 Hours**

a. Postural deformities.
b. Stress management.
c. Aerobics.
d. Traditional Games.

**Semester: IV**

**PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II**

| | | | |
|---|---|---|---|
| Course Code | **22PE49** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:1** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**

At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organization and administration of sports and games.

**Module IV: Ethics and Moral Values** **5 Hours**

| |
|---|
| Ethics in Sports<br>Moral Values in Sports and Games |

**Module V: Specific Games (Any one to be selected by the student)** **20 Hours**

| |
|---|
| Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.<br>Throwball – Service, Receive, Spin attack, Net Drop & Jump throw.<br>Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.<br>Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.<br>Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.<br>Athletics (Track / Field Events) – Any event as per availability of Ground. |

**Module VI: Role of Organization and Administration** **05 Hours**

**Semester III – VI Semester**
**YOGA FOR A BETTER LIFE**

| | | | |
|---|---|---|---|
| Course Code | **22YO39** | CIE Marks | 100 / Sem. |
| Teaching Hours / Week (L:T:P: S) | | SEE Marks | --- |
| Total Hours of Pedagogy per semester | **24 - 28 hours (Theory + practical)** | Total Marks | 100 / Sem. |
| Examination nature (SEE): | **Objective type Theory / Practical / Viva-Voce** | | |

**Course objectives:**
1. To enable the student to have good health.
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.
5. To attain higher level of consciousness.

**The Health Benefits of Yoga**
The benefits of various yoga techniques have been supposed to improve
- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

  The system has been advocated as a complementary treatment to aid the healing of several ailments such as
- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

  The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

  If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system

- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills

- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

**Semester III**

**YOGA SYLLABUS**

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health

Rules to be followed during yogic practices by practitioner Yoga its misconceptions,
**Difference between yogic and non-yogic practices**
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**
a. Sitting: 1. Padmasana, 2. Vajrasana
b. Standing: 1. Vrikshana, 2. Trikonasana
c. Prone line: 1. Bhujangasana, 2. Shalabhasana
d. Supine line: 1. Utthitadvipadasana, 2. Ardhahalasana

**Semester IV**
Patanjali's Ashtanga Yoga, its need and importance.
Yama: Ahimsa, Satya, Asteya, Brahmacarya, Aparigraha
Niyama: Shoucha, Santosh, Tapa, Svaadhyaya, Eshvarapranidhan, Suryanamaskar12 Count- 4 Rounds of Practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**
a. Sitting: 1. Sukhasana, 2. Paschimottanasana
b. Standing: 1. Ardhakati Chakrasana, 2. Parshva Chakrasana
c. Prone line: 1. Dhanurasana,
d. Supine line: 1. Halasana, 2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes / min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama: 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana, 4. Chandra Bhedana 5. Nadishodhana

**SEMESTER V**

Patanjali'sAshtanga Yoga its need and importance. Ashtanga Yoga
1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**
a. Sitting: 1. Ardha Ushtrasana, 2.Vakrasana, 3.Yogamudra in Padmasana
b. Standing: 1. UrdhvaHastothanasana, 2.Hastapadasana, 3.ParivrittaTrikonasana, 4.Utkatasana
c. Prone line: 1. Padangushtha Dhanurasana, 2.Poorna Bhujangasana / Rajakapotasana
d. Supine line: 1. Sarvangasana, 2.Chakraasana, 3.Navasana / Noukasana, 4.Pavanamuktasana
Revision of practice 60 strokes / min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama
1. Ujjayi 2. Sheetali 3. Sheektari

**Semester VI**

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi
Asana by name, technique, precautionary measures and benefits of each asana

**Different types of Asanas**
a. Sitting: 1. Bakasana, 2.Hanumanasana, 3.Ekapada Rajakapotasana, 4.Yogamudra in Vajrasana
b. Standing: 1. Vatayanasana, 2.Garudasana, 3.
c. Balancing: 1. Veerabhadrasana, 2.Sheershasana
d. Supine line: 1. Sarvangasana, 2.Setubandha Sarvangasana, 3.Shavasanaa (Relaxation posture).

Revision of Kapalabhati practice 80 strokes / min - 3 rounds

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. Bhramari
Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas , method to follow and usefulness.

**Suggested Learning Resources:**
**Books:**

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyengar
3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
5. Yoga for Children –step by step – by Yamini Muthanna

**Web links and Video Lectures (e-Resources): Refer links**
https: //youtu.be/KB-TYlgd1wE
https: //youtu.be/aa-TG0Wg1Ls

**Semester: 3rd to 6th**
**NATIONAL SERVICE SCHEME (NSS)**

| | | | |
|---|---|---|---|
| Course Code | **22NS39** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P: S) | **0:0:3:1** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (SEE) | Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th Semester) | | |
| Credits | NCMC – Non Credit Mandatory Course<br>(Completion of the course shall be mandatory for the award of degree) | | |

**Course objectives:**
National Service Scheme (NSS) will enable the students to:
1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**General Instructions - Pedagogy:**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

**National Service Scheme (NSS) – Contents:**
1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

**NOTE:**
- Student / s in individual or in a group should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

**Semester wise from 3rd to 6th semester**
**DISTRIBUTION OF ACTIVITIES –**

| Semester | Topics / Activities to be Covered |
|---|---|
| 3rd Sem. | 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.<br>2. Waste management– Public, Private and Govt organization, 5 R's.<br>3. Setting of the information imparting club for women leading to contribution in social and economic issues. |
| 4th Sem. | 4. Water conservation techniques – Role of different stakeholders– Implementation.5<br>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.<br>6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. |
| 5th Sem. | 7. Developing Sustainable Water management system for rural areas and implementation approaches.<br>8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,<br>9. Spreading public awareness under rural outreach programs.(minimum5 programs).<br>10. Social connect and responsibilities. |
| 6th Sem. | 11. Plantation and adoption of plants. Know your plants.<br>12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).<br>13. Govt. school Rejuvenation and helping them to achieve good infrastructure. |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.**

| SN | Topic | Group size | Location | Activity execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers Land / Villages / Roadside / Community Area / College Campus Etc., | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 2. | Waste management– Public, Private and Govt. organization, 5 R's. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,, | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 3. | Setting of the information imparting club for women leading to contribution in social and economic issues. | May be individual or team | Women Empowerment Groups / Consulting NGOs & Govt. Teams / College Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 4. | Water conservation techniques – Role of different stakeholders– Implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 5. | Preparing an actionable business proposal for enhancing the village income and approach for implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 6. | Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. | May be individual or team | Local Government / Private / Aided Schools / Government Schemes Officers / Etc., | School selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 7. | Developing Sustainable Water management system for rural areas and implementation approaches. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 8. | Contribution to any national level | May be individual or | Villages / City Areas / Grama | Group selection / pro per | Report should be submitted by | Evaluation as per the |

| | | | | | | |
|---|---|---|---|---|---|---|
| | initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc., | team | Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | consultation / Continuous monitoring / Information board | individual to the concerned evaluation authority | rubrics Of scheme and syllabus by NSS officer |
| 9. | Spreading public awareness under rural outreach programs (minimum5 programs) / Social connect and responsibilities. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 10. | Plantation and adoption of plants. Know your plants. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 11. | Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs). | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 12. | Govt. school Rejuvenation and helping them to achieve good infrastructure. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government/ Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

**Plan of Action (Execution of Activities for Each Semester)**

| SN | Practice Session Description |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.



**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems / issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.
CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**SUGGESTED LEARNING RESOURCES:**
**Books:**
**NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
Government of Karnataka, NSS cell, activities reports and its manual.
Government of India, NSS cell, Activities reports and its manual.

**Semester: III**
**Course Name: ADDITIONAL MATHEMATICS-I**
**(For Lateral Entry Students)**

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP31** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **00** | Exam Hours | **-** |

**Pre-requisites:**
1. Algebraic formulae
2. Differentiation
3. Integration
4. Trigonometric formulae

**Module – 1** **08 Hours**

**Linear Algebra**
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
**Self-Study:** Gauss Jordon Method

**Module - 2** **08 Hours**

**Differential Calculus:**
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
**Self-Study:** Taylor's series expansion.

**Module – 3** **08 Hours**

**Vector Differentiation:**
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields-Problems.
**Self-Study:** Angle between two surfaces[RBT Levels: L1, L2,L3]

**Module – 4** **08 Hours**

**Integral Calculus:**
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\ Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
**Self-Study:** Change of Order of Integration.

**Module – 5** **08 Hours**

**Ordinary Differential Equations:**
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli's equation.
**Self-Study:** Homogeneous differential equations

**Course outcomes:**
1. Upon Completion of this course, student will be able to,
2. Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.

3. Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
4. Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
5. Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
6. Solve first order linear differential equations analytically using standard methods.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43rd Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | John Willy & Sons | 10th Ed. (Reprint). 2016 |
| 3 | Additional Mathematics-1 | Dr. Pandurangappa | Sanguine Technical Publishers | 4th Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V. Ramana | Tata McGraw-Hill | 11th Edition.2010 |

**Semester: IV**
**Course Name: Applied Mathematics for Electrical and Electronics Engineering**

| | | | |
|---|---|---|---|
| Course Code | **22MEE41** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**

- Knowledge of infinite series, trigonometry, calculus, analytical geometry, signals and systems properties.

**Course objectives:**
This course will enable students

1. To find the association between attributes and the correlation between two variables
2. To Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.
3. To explain Fourier Transform representation of signals and the properties of Fourier Transforms.
4. To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems.
5. To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains.

**Module – 1: Curve Fitting, Correlation and regressions** **08 Hours**
**(RBT Levels: L1, L2 and L3)**

Principles of least squares, Curve fitting by the method of least squares in the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ax^b$. Correlation, Co-efficient of correlation, lines of regression. Angle between regression lines, standard error of estimate, rank correlation.
**Applications**: To fit the given data into different curves
**Self-Study**: Fitting of curves in the form $y = ae^{bx}, y = ab^x$.

**Module – 2: Fourier series** **08 Hours**

Periodic functions, Dirichlet's condition, conditions for Fourier series expansion, Fourier series of functions with period $2\pi,$ even and odd functions. Half range Fourier series. Practical harmonic analysis.
**Applications:** Problems on Fourier Series as applied to Signals and Systems
**Self- Study:** Fourier Series with arbitrary period.

**Module – 3: Fourier Transforms** **08 Hours**

Infinite Fourier Transforms: Definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Problems. DTFT and Inverse DTFT, Applications.
**Applications:** Problems on DTFT as applied to Signals and Systems
**Self-Study:** Properties of Fourier Transforms, sine & cosine Transforms.

**Module – 4: Z-Transforms** **08 Hours**

Introduction, Z-transform, properties of ROC, properties of Z-transforms. Inverse Z-transforms, method of partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations.
**Applications:** Solving Difference equations using Z-transforms
**Self-Study:** Method of Power series.

**Module – 5: Time - Domain representation for LTI Systems** **08 Hours**

Convolution sum and convolution integral, impulse response, properties, solution of differential and difference equations.
**Applications:** Problems on Convolution sum and convolution integrals as applied to signals and systems
**Self-Study:** Block diagram representation of LTI systems.

**Course Outcomes:**

1. Apply the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
2. Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
3. Use Fourier transforms to analyze problems involving continuous-time signals
4. Apply the continuous time Fourier transform, discrete time Fourier transform, z-Transform, to the analysis of LTI continuous and discrete-time systems
5. Solve differential equations and difference equations of system to determine response

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Text books** | | | | |
| 1 | Higher Engineering Mathematics | B. S. Grewal | Khanna Publications, 44 th Ed., | 2021 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | John Wiley & Sons, | 10 th Ed., 2018 |
| 3 | Signals & Systems | Simon Haykin, Berry Van Veen | Wiley | 2 nd Edition |
| **Reference Books** | | | | |
| 1 | Signals & Systems | Nagoor Kani | McGraw Hill | 1st Edition |
| 2 | Signals & Systems | H.P. Hsu, R Ranjan | Schaum’s outline series, TMH | printed in 2005 |

**e-Resources:**
https://www.youtube.com/playlist?list=PLC210462711083C4

**Semester: IV**
**Course Name: Engineering Electromagnetics**

| | | | |
|---|---|---|---|
| **Course Code** | **22EC42** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **2:2:2** | **SEE Marks** | **50** |
| **Total Hours of Pedagogy** | **40(T)+20(P)** | **Total Marks** | **100** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:** Fundamental physics, Vector calculus, Integral and differential calculus.

**Course objectives:** This Theory course enables students to

- **Understand Electromagnetic Fundamentals:** Develop a comprehensive understanding of the fundamental concepts and principles of electromagnetism, including electric and magnetic fields, charge distributions, and Maxwell's equations.
- **Analyze Static Electric and Magnetic Fields:** Apply mathematical techniques and fundamental principles to analyze static electric and magnetic fields. Understand the behavior of electric and magnetic fields in different materials and configurations.
- **Study Time-Varying Fields and Maxwell's Equations:** Analyze time-varying electric and magnetic fields and their relationship to Maxwell's equations. Understand the role of displacement current and the propagation of electromagnetic waves.
- **Investigate Electromagnetic Waves:** Study the characteristics, properties, and behavior of electromagnetic waves in different media. Analyze the generation, transmission, and reception of electromagnetic waves.
- **Develop Problem-Solving and Analytical Skills:** Develop problem-solving skills by applying mathematical and analytical techniques to solve complex electromagnetic problems. Enhance critical thinking and analytical abilities through analysis and interpretation of electromagnetic phenomena.
- **Research and Analytical Abilities:** Cultivate research skills by studying and reviewing scientific literature related to electromagnetic theory. Develop the ability to analyze and critically evaluate research findings in the field.
- **Enhance Communication and Presentation Skills:** Improve written and oral communication skills through technical report writing and presentation of electromagnetic theory concepts, experiments, and research findings.

**Module – 1** **10 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Prerequisites:** Review of Vector Algebra, Vector Calculus, Coordinate Systems and Coordinate transformations. **(Only for CIE) (Text 2: 1.1-1.8, 2.1-2.4, 3.1-3.4)**<br>**Coulomb's Law and Electric Field Intensity:** Experimental law of Coulomb (Vector form), Electric field intensity, Field due to finite charge distributions, Field due to infinite line charge and infinite Sheet of charge, Numerical Problems. **(Text 1: 2.1-2.5)**<br>**Gauss's law and its Applications:** Electric flux density, Gauss law (Statement and Proof), Applications of Gauss law, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), divergence theorem, Numerical Problems **(Text 1: 3.2 to 3.7)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving, Conceptual Demonstration through Simulation tools (HFSS/MATLAB)<br>**Self-study topics:** Difference between Circuit theory and Electromagnetic field theory |

| **Module – 2** | **08 Hours (RBT Levels: L1, L2 & L3)** |
|---|---|
| **Energy, Potential and Conductors:** Energy expended or work done in moving a point charge in an electric field, Definition of potential difference and potential, The potential difference due to point charge and system of charges, Potential gradient, Numerical Problems.**(Text 1: 4.1 to 4.4 and 4.6)**<br>Current and Current density, Continuity of current equation. **(Text 1: 5.1, 5.2)**<br>**Poisson's and Laplace's Equations:** Derivation of Poisson's and Laplace's Equations, Numerical problems on Laplace equation, Capacitance calculation for different configurations using Laplace's equation, Uniqueness theorem. **(Text 1: 7.1to 7.3)** | |
| **Teaching-Learning Process:** | |
| Chalk and talk method, Power Point Presentation, YouTube videos, Problem solving.<br>**Self-study topics:** Energy density, Applications of Poisson's equation | |

| **Module – 3** | **08 Hours (RBT Levels: L1, L2 & L3)** |
|---|---|
| **Steady Magnetic Fields:** Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Concept of Scalar and Vector Magnetic Potentials, Numerical problems. **(Text 1: 8.1to 8.6)**<br>**Magnetic Forces:** Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Numerical problems. **(Text 1: 9.1 to 9.3)** | |
| **Teaching-Learning Process:** | |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving.<br>**Self-Study topics:** Magnetic Materials/Circuits, Mutual Inductance. Magnetic Energy Storing issues. | |

| **Module – 4** | **07 Hours (RBT Levels: L1, L2 & L3)** |
|---|---|
| **Time Varying Fields and Maxwell's equations:** Faraday' law of Electromagnetic Induction - Integral form and Point form, Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems. **(Text 1: 10.1 to 10.4)** | |
| **Teaching-Learning Process:** | |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving.<br>**Self Study topics:** History of Maxwell's equations, Hertz experiments, EM radiation phenomena. | |

| **Module – 5** | **07 Hours (RBT Levels: L1, L2 & L3)** |
|---|---|
| **Uniform Plane Waves:** Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media ($\gamma$, $\alpha$, $\beta$, $\eta$) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text 1: 12.1to 12.4) Electromagnetic Compatibility (EMC):** Introduction, Goals and importance of EMC, Applications of EMC. **(Web Link 3)** | |
| **Teaching-Learning Process:** | |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem Solving, Demonstration through Simulation tools (HFSS/MATLAB).<br>**Self-Study topics:** Polarization of electromagnetic waves, phase velocity, and group velocity, Electromagnetic Interference (EMI). | |

## PRACTICAL COMPONENT OF IPCC

| SN | Experiments |
|---|---|
| **PART A: Simulation based Experiments using MATLAB/Python/HFSS or any other Suitable software.** | |
| 1 | Simulate experiments that involve vector calculus Divergence,and vector operators (Gradient, CURL, dot product and cross product). |
| 2 | Verify Coulomb's law by measuring the force between two charged objects at different distances and comparing it with the inverse square relationship. |
| 3 | Calculate and visualize the electric field of a point charge and also with multiple point charges to observe how their electric fields combine. |
| 4 | Demonstrate Gauss's law by calculating the electric flux through a closed Gaussian surface for different charge distributions. |
| 5 | Simulate the application of Laplace's equation to calculate the capacitance of a parallel plate capacitor. |
| 6 | Simulate the magnetic field produced by a current-carrying straight wire using and investigate the spatial distribution of the magnetic field strength and direction around the wire to visualize its magnetic field lines. |
| 7 | Simulate Faraday's law by changing the magnetic field within a loop and observing the induced EMF and current. |
| 8 | Simulate the behavior of uniform plane waves in different mediums and observe changes in their speed and direction. |
| **PART B: Demonstration Experiments (Not for SEE)** | |
| 1 | **Charging by Friction:** Rub a comb against your hair to charge it, then observe how the charged comb attracts small pieces of paper<br>**Charging by Induction:** Use a charged balloon to induce a charge on aluminum can, causing it to be attracted to the balloon.<br>**Static Electricity with Balloons:** Inflate a balloon and rub it against your clothes to generate static electricity. Use it to attract small pieces of paper or make your hair stand up. |
| 2 | **Magnetic Fields with Compass:** Place a bar magnet under a piece of paper and sprinkle iron filings on top. Observe how the filings arrange themselves along the magnetic field lines. |
| 3 | **Simple Motors:** Create a simple motor using a battery, a coil of wire, and a magnet. When the coil is placed between the magnet poles and connected to the battery, it will rotate. |
| 4 | **Oersted's Experiment:** Pass an electric current through a wire placed above a compass needle. Observe how the current generates a magnetic field that deflects the needle. |
| 5 | **Faraday's Electromagnetic Induction:** Move a magnet in and out of a coil of wire and observe the induced current. You can also use a coil to light up a bulb. |
| 6 | **Homemade Electromagnet:** Wrap a coil of wire around a nail, connect the ends to a battery, and observe how the nail becomes magnetic. |
| 7 | **Simple Capacitor:** Create a simple capacitor using two metal plates and an insulator between them. Charge it using a battery and observe the spark when discharged. |
| | **PART C: Open Ended/Mini Lab Experiments (Not for SEE)** |
| 1 | **Any Open-Ended Experiments** |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Solve problems on Electric force, electric field intensity due to point, linear, volume charges by applying Coulombs Law and Gauss's Law.
2. Determine Energy and Potential for various charge distributions and apply continuity equation of current to calculate flow of current, total charge, charge density etc for Conductors.
3. Apply Poisson's and Laplace equations for solving boundary value problems associated with electrostatics and magneto-statics.
4. Analyze the applications of magneto-statics by applying Biot-Savart law, Ampere's circuital law and derive the concepts of magnetic forces and materials to characterize the magnetic circuits.
5. Analyze Maxwell's equations for Static fields, time varying fields, EM waves in free space, conductors and Evaluate power associated with EM waves using Poynting theorem.
6. Conduct Open-Ended Experiments/Mini lab projects related to applications of electromagnetic systems and propose innovative solutions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Engineering Electromagnetics | William H. Hayt, John A. Buck, M. Jaleel Akhtar | Tata McGraw- Hill | 8th Edition, 2014. |
| 2 | Elements of Electromagnetics | Matthew N. O. Sadiku | Oxford niv.Press | 4th Edition |
| Reference Books | | | | |
| 1 | Electromagnetic Waves and Radiating Systems | E.C. Jordan and K. G. Balmain | PHI | 2nd Edition, 2000 |
| 2 | Engineering Electromagnetics | Nathan Ida, | Springer (India) Pvt. Ltd., New Delhi | 2nd Edition, 2005 |
| 3 | Electromagnetics- Schaum's Outline series | Joseph A. Ediminister | Tata McGraw-Hill | Revised 2nd Edition, 2014 |
| 4 | Electromagnetic Theory Practical Book for Engineering Students | Dr. Rishu Bhati | Bharath Publications | -- |

**e-Resources/ Web Links**

1 https://nptel.ac.in/courses/108/106/108106073/
2 https://nptel.ac.in/courses/117/103/117103065/
3 https://archive.nptel.ac.in/courses/108/106/108106138/
4 https://www.ee.iitb.ac.in/course/~vel/
5 https://nt7-mhe-complex-assets.mheducation.com/nt7-mhe-complex-assets/Upload-20190715/InspireScience6-8CA/CT05/index.html
6 https://phet.colorado.edu/en/simulations/faraday

**Semester: IV**
**Course Name: Control Systems**

| | | | |
|---|---|---|---|
| Course Code | **22EC43** | CIE Marks | **50** |
| Teaching Hours/Week (L: T:P) | **2:2:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40(T)+20(P)** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:** Basic Engineering Mathematics, Introduction to Electrical Circuits, Linear Algebra, and Differential Equations.

**Course objectives:**
This Theory course enables students to
1. Understand the foundational principles of control systems, including their types, components, and applications.
2. Analyze the time response characteristics of feedback control systems and assess their performance metrics.
3. Apply stability analysis techniques to determine the stability of control systems, including root locus and frequency domain methods.
4. Comprehend the basics of digital control systems and their advantages over analog counterparts.
5. Utilize Simulink and MATLAB to simulate and implement control system designs, solidifying practical skills for real-world applications.

**Module – 1** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Introduction to Control Systems:** Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Computational approaches for Transfer function- Block diagram algebra and Signal Flow graphs or use of simulation tools etc. |
| **Teaching-Learning Process:** |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving. |

**Module – 2** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Time Response of feedback control systems:** Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). |
| **Teaching-Learning Process:** |
| Chalk and talk method, Power Point Presentation, YouTube videos, Problem solving, Demonstration through Simulation tools (MATLAB/SIMULINK). |

**Module – 3** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Stability analysis:** Introduction, Concepts of stability, Necessary conditions for Stability, Routh stability criterion, special cases of Routh stability. Application of Routh's criterion. Relative stability analysis & Determining range values of K. Marginal K and frequency of sustained oscillations, advantages and limitations of Routh's array |
| **Teaching-Learning Process:** |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving. |

**Module – 4** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Root locus and Frequency domain analysis f o r stability:** Introduction, Basic concepts of Root-Locus, Angle and magnitude condition, rules for construction of root loci, advantages of Root locus method. Introduction to Bode plots, advantages and limitations of frequency domain approach, Correlation between time and frequency response, bode plot of standard factors, calculation of G.M and P.M from bode plot. Polar and Nyquist plot: Introduction, basic concepts of polar and Nyquist plots. |
| **Teaching-Learning Process:** |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving, Demonstration through Simulation tools (MATLAB/SIMULINK). |

**Module – 5** **08 Hours (RBT Levels: L1, L2 & L3)**

| |
|---|
| **Introduction to Digital Control System:** Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems. |
| **Teaching-Learning Process:** |
| Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem Solving, Demonstration through Simulation tools (MATLAB/SIMULINK). |

**PRACTICAL COMPONENT OF IPCC**

| SN | Experiments |
|---|---|
| | **PART A: Simulation based Experiments using MATLAB/Simulink/Python or any other Suitable software.** |
| 1 | Determination of time response specification of a second order Under damped System, for different damping factors. |
| 2 | Determination of frequency response of a second order System |
| 3 | Using suitable simulation package, draw Root locus & Bode plot of the given transfer function. |
| 4 | Using suitable simulation package, obtain the time response from state model of a system. |
| 5 | Generate Step, Ramp and impulse functions for $1^{st}$ order systems |
| 6 | Generate Step, Ramp and impulse functions for $2^{nd}$ order systems |
| | **PART B: Demonstration Experiments** |
| 1 | Implementation of PI, PD Controllers. |
| 2 | Implement a PID Controller and hence realize an Error Detector. |
| 3 | Demonstrate the effect of PI, PD and PID controller on the system response. |
| | **PART C: Open Ended/Mini Lab Experiments (Not for SEE)** |
| 1 | Any Open-Ended Experiments |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Develop the mathematical model of mechanical and electrical systems.
2. Develop transfer function for a given control system using suitable computational tool.
3. Determine the time domain specification s for first and second order systems.
4. Determine the stability y of a system in the time domain and frequency domain
5. Conduct Open-Ended Experiments/Mini lab projects related to applications of Control systems and propose suitable solutions.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Control Systems Engineering | J Nagrath, M. Gopal | New age international Publishers | 5th edition, 2005 |
| **Reference Books** | | | | |
| 1 | Modern Control Engineering | K. Ogata | Pearson Education Asia/ PHI | 4th Edition, 2002. |
| 2 | Automatic Control Systems | Benjamin C. Kuo | John Wiley India Pvt. Ltd. | 8th Edition, 2008. |
| 3 | Feedback and Control System | Joseph J Distefano III et al. | Schaum's Outlines, TMH | 2nd Edition 2007. |
| **e-Resources/ Web Links** | | | | |
| 1 | https://nptel.ac.in/courses/108106098 | | | |

**Semester: IV**
**Course Name: Communication Systems- I**

| | | | |
|---|---|---|---|
| Course Code | **21EC44** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:** Signals and Systems, Probability theory, Random Processes.

**Course objectives:**
This Course enables students to target the following attributes:
1. Preparation: To prepare students with basic knowledge of communication theory principles
2. Core Competence: To equip students with a basic foundation in Communication Engineering fundamentals required for the Design, Analysis and Development of various analog communication subsystems.
3. Professionalism: To inculcate ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, Industrial Visits and ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.
4. Learning Environment: To facilitate students to experience task-based learning, peer learning, experimental learning and enable students to inculcate self-study culture.

**Module – 1** **08 Hours**

| |
|---|
| **Introduction to Communication System:** Introduction, Elements of a Communication System, Need for Modulation, Electromagnetic Spectrum and Typical Applications, Terminologies in Communication Systems, Basics of Signal Representation and Analysis.<br>**Amplitude Modulation (AM) Systems:** Introduction, Time and Frequency domain representation, AM Generation- Switching Modulator, AM Detection- Envelop detector, significance of RC time constant in envelop detector, virtues, limitations, and modifications of amplitude modulation, Comparison of AM Modulation techniques- Standard AM, DSBSC, SSB and VSB, Frequency translation, Frequency division Multiplexing, Quadrature carrier Multiplexing. **(Text-1: 3.1,3.2,3.4,3.7,3.8 & Text-2: 1.1-1.6)** |
| **Self-study topics:** |
| Basic tools for Communication-Fourier Transforms, Trigonometric relations, Dirac Delta function. |

**Module - 2** **08 Hours**

| |
|---|
| **Angle Modulation:** Basic Definitions- Description of phase modulation (PM) and Frequency modulation (FM), Properties of Angle modulated waves, Relationship between FM and PM. Frequency Modulation (FM): Narrow band FM, Wideband FM, transmission bandwidth of FM signals using Carson's Rule.<br>**Generation of FM Signals:** Direct and Indirect method.<br>**Demodulation of FM Signals:** Balanced frequency discriminator and Phase locked loop. FM stereo Multiplexing, Super heterodyne Receiver. **(Text-1: 4.1-4.6 &Text-2: Chapter 4)** |
| **Self-study topics:** |
| EM Spectrum for FM Broadcasting system [Text-3], Survey on various FM stations around the state. |

**Module – 3** **08 Hours**

| |
|---|
| **Noise in Analog Modulation:** Introduction, shot noise, thermal noise, white noise, Narrow band noise. Representation of noise in-terms of In phase and quadrature components, representation of noise in-terms of envelop and phase components.<br>**Noise in AM Receivers:** Signal to Noise Ratios, AM receiver Model, Noise in AM receivers, and Noise in DSBSC receivers.<br>**Noise in FM Receivers:** FM receiver Model, Noise in FM reception, FM threshold effect, pre- emphasis and de-emphasis in FM. **(Text-1: 5.10,6.1-6.6)** |
| **Self-study topics:** |
| Gaussian Distribution, AWGN, Noise Figure, Power Spectral Density. |

**Module – 4** **08 Hours**

| |
|---|
| **Analog to Digital Transition:** Introduction, Why Digitize Analog Sources? The Low pass Sampling Process, Practical aspects of sampling and signal recovery, Types of Sampling (Natural, Flat top/Sample and Hold, Impulse), Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Theme Example— PPM in Impulse Radio.**(Text-1: 7.1-7.7)** |
| **Self-study topics:** |
| Bandwidth requirements for TDM, T1 Carrier Systems- A Case Study (Text 3: 6.3), Importance of Interleaving. |

**Module – 5** **08 Hours**

| |
|---|
| **Analog to Digital Transition (Cont..):** The Quantization Random Process, Quantization Noise, Types of Quantization, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation, Application examples- (a) Video + MPEG and (b) Vocoders.<br>**Line Codes (RZ & NRZ):** Unipolar, Polar, Bipolar, Manchester Coding/Signaling. Other baseband signaling- HDB3, BnZs **(Text-1: 7.8-7.11 & Text-3: 6.8,7.1,7.2)** |
| **Self-study topics:** |
| Digital Multiplexing. |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply mathematical tools/transformations to analyze the performance of amplitude modulation schemes (Standard AM, DSBSC, SSB & VSB).
2. Analyze FM modulated/demodulated signals from the learning recourses and realize the design principles of FM in audio broadcasting.
3. Characterize the influence of channel noise on the modulated signals and analog receivers.
4. Relate the design principles of analog to digital transformations in context to digital signal processing/multimedia applications.
5. Design and Conduct experiment by way of simulation or emulation on analog communication subsystems targeting to specific radio applications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Communication Systems | Simon Haykins & M Moher | John Willey India Pvt. Ltd. | 5th Edition & 2010 |
| 2 | Electronic Communication Systems | George Kennedy, Bernard Davis & S R M Prasanna | McGraw Hill Education (India) Private Limited | 5th Edition & 2015 |
| 3 | Modern Digital and Analog Communication Systems | B P Lathi & Zhi Ding | Oxford University Press | 4th Edition & 2010 |
| Reference Books | | | | |
| 1 | Principles of Communication Systems | H Taub & D L Schilling | TMH | 3rd Edition & 2011 |
| 2 | An Introduction to Analog and Digital Communication | Simon Haykins | John Willey India Pvt. Ltd. | 2008 |
| e-Resources/ Web Links | | | | |
| 1 | https://archive.nptel.ac.in/courses/108/104/108104091/ -NPTEL MOOC Lecture Material (Videos, Transcripts, Book)-Principles of Communication Systems-I by Prof. Aditha K Jagannathan, Dept. of E&CE, IIT Kanpur. | | | |

**IV Semester**
**Name of the Laboratory: Communication Laboratory-I**

| | | | |
|---|---|---|---|
| Course Code | **21ECL45** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Pre-requisites:** Signals and Systems, Analog and Digital circuit fundamentals, Probability theory and Random Processes.

**Course Objectives:**
This laboratory course enables students to
1. Design Circuits for analog signal processing like filters, mixers etc.
2. Realize the electronic circuits to perform analog and pulse modulations and demodulations.
3. Design the circuit to sample an analog signal. Also verify the sampling theorem and relate the signal and its spectrum before and after sampling.
4. Comprehend the critical design issues, advantages, disadvantages, and limitations of analog communication systems.
5. Demonstrate their practical learning skills in both hand-on and simulation-based experimentation (Blend of both hardware and software) on various communication system applications which involve signal transmission/ recovery, modulation process, multiplexing, analog to digital signal transformations, line coding etc.

**List of Experiments:**

| **Part A: Design of Experiments using Discrete Components** | |
|---|---|
| **SN** | **Experiments** |
| 1 | Design of active second order Butterworth Low pass and high pass filters. |
| 2 | Amplitude Modulation and Demodulation of Standard AM |
| 3 | FM Signal generation (IC8038/IC2206 can be used) |
| 4 | Pulse amplitude modulation and demodulation |
| 5 | Design and test BJT/FET Mixer |
| **Part B: Design based /Simulation based Experiments using MATLAB/SCILAB/SIMULINK/LABVIEW etc.** | |
| 1 | Illustration of<br>(a) AM modulation and demodulation and display the signal and its spectrum. (b) DSB- SC modulation and demodulation and display the signal and its spectrum. |
| 2 | Illustration of FM modulation and demodulation and display the signal and its spectrum |
| 3 | Illustration of Pulse code modulation and demodulation |
| 4 | Illustration of Delta Modulation and the effects of step size selection in the design of DM encoder |
| 5 | Illustrate the process of sampling and reconstruction of low pass signals. Display the signals and its spectrums of both analog and sampled signals. |
| 6 | Simulate Line codes and Generate NRZ, RZ Unipolar and Polar signaling waveforms. |

| **Part C: Demo/Kit based/ Open Ended Experiments (Only for CIE, not for SEE)** | |
|---|---|
| 1 | Demonstrate Time Division Multiplexing and De-multiplexing of two band limited signals. |
| 2 | Design of active Butterworth Band pass filter using Op-amp. |
| 3 | Pulse width Modulation |
| 4 | Phase Locked Loop Synthesis |
| 5 | Any Open ended Experiments/Mini Lab Projects |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Design and Validate 2nd order active filters as per the given design Specifications (Cut-off frequency, Roll off factor, Gain, Bandwidth etc) and stability requirements.
2. Demonstrate the AM and FM modulation/Demodulation for a given specification through discrete circuit implementation and Measure its performance parameters (Modulation Index, Carrier frequency, Bandwidth etc).
3. Design and Test the Pulse Amplitude Modulation/demodulation using discrete circuits and Comment on sampling criteria/Conditions.
4. Test BJT/FET Mixer and realize the need of mixer and local oscillator in superheterodyne receivers.
5. Simulate/Emulate assorted communication system applications that involve signal transmission/ recovery, modulation process, multiplexing, analog to digital signal transformations, line coding etc.

**Suggested Learning Resources:**

| **SN** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Communication Systems | Simon Haykins & M Moher | John Willey India Pvt. Ltd. | 5th Edition & 2010 |
| 2 | Modern Digital and Analog Communication Systems | B P Lathi & Zhi Ding | Oxford University Press | 4th Edition & 2010 |
| 3 | Principles of Electronics Communication Systems | Louis E Frenzel | TMH | 2016 |
| | Reference Books | | | |
| 1 | An Introduction to Analog and Digital Communication | Simon Haykins | John Willey India Pvt. Ltd. | 2008 |
| 2 | Principles of Communication Systems | H Taub & D L Schilling | TMH | 2011 |

**e-Resources/Web Links**

1. https://archive.nptel.ac.in/courses/108/104/108104091/ -NPTEL MOOC Lecture Material (Videos, Transcripts, Book)-Principles of Communication Systems-I by Prof. Aditha K Jagannathan, Dept. of E&CE, IIT Kanpur.
2. https://www.etti.unibw.de/labalive/ -labAlive Virtual Communications Lab

**Semester: IV**
**Course Name: 8051 Microcontroller**

| | | | |
|---|---|---|---|
| Course Code | **22EC461** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basic knowledge of microprocessors and microcontrollers
- Familiarity with programming concepts, such as variables, data types, control structures (if- else, loops), and functions.
- Some exposure to assembly language programming concepts and syntax, as the 8051 Microcontroller is typically programmed in assembly.

**Course objectives:**
1. Describe the architecture of the 8051 microcontroller, including its registers and pin diagram.
2. Understand and utilize data transfer, arithmetic, logical, branch, and bit manipulation instructions.
3. Explain the concept of the stack and its importance in subroutine execution.
4. Describe the operation of timers and counters in the 8051 microcontroller.
5. Develop assembly language programs to generate and handle external interrupts using switches.

**Module – 1** **08 Hours (RBT Levels: L1, L2)**

| |
|---|
| **8051 Microcontroller:** Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.<br>Chapter –1 (Text 1) |
| **Teaching-Learning Process:** |
| Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 2** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **8051 Instruction Set:** Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. Chapter – 2 (Text1) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PowerPoint presentation |

**Module – 3** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **8051 Stack, I/O Port Interfacing and Programming:** 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. **Chapter – 4 (Text1)** |
| Teaching-Learning Process: |
| Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 4** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| **8051 Timers and Serial Port:** 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. **Chapter 9 & 10 (Text 1)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, YouTube videos, PowerPoint presentation |

**Module – 5** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| 8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming. **Chapter – 14 (Text 1)** |
| **Teaching-Learning Process:** |
| Chalk and talk method, YouTube videos, PowerPoint presentation |

**Course Outcomes:**

At the end of the course, the student will be able to:

1. Outline the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2. Write an Assembly level programs using 8051 instruction set.
3. Demonstrate the understanding of the Interrupt system, operation of Timers/Counters and Serial port of 8051.
4. Write an Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch.
5. Write an Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | The 8051 Microcontroller and Embedded Systems – using assembly and C | Muhammad Ali Mazidi & Janice Gillespie Mazidi | PHI | 2006 |
| Reference Books | | | | |
| 1 | The 8051 Microcontroller Architecture and Programming & Applications | Kenneth J Ayala | Penram International | 2005 |
| | | | | |

**e-Resources:**

https://archive.nptel.ac.in/courses/108/105/108105102/
https://onlinecourses.nptel.ac.in/noc22_ee12/preview

**Semester: IV**
**Course Name: OOPS using C++**

| | | | |
|---|---|---|---|
| Course Code | **22EC462** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basic Knowledge of Programming Language
- Knowledge of Procedural Oriented Language like 'C'

**Course objectives:**

Upon completion of the course, students will be well-versed in C++ programming, object- oriented concepts, and they will possess problem-solving skills and be capable of designing efficient algorithms to address a wide range of computational challenges, making them competent software developers and programmers. This course is targeting the following key aspects:

1. **Master C++ Programming Basics:**
   - Understand the syntax and semantics of C++ programming language.
   - Learn about variables, data types, operators, and control structures in C++.
   - Develop proficiency in writing C++ programs to solve basic computational problems.

2. **Explore Objects and Classes:**
   - Grasp the principles of object-oriented programming (OOP).
   - Create and use classes and objects to model real-world entities.
   - Implement encapsulation, abstraction, inheritance, and polymorphism.

**Module – 1** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **C++ Programming Basics:** Need for object-oriented programming, procedural languages, characteristics of OOPs, basic program construction, preprocessor directives, comments, data types, manipulators Type Conversion. (Text 1: 1.1-1.3, 2.1- 2.5) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Hands-on Coding through compilation. |

**Module – 2** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Structures:** Structures, enumerated data types. (Text 1: 4.1-4.2)<br>**Functions:** Passing arguments, returning values, reference arguments, overloaded functions, inline functions, variable and storage classes. (Text 1: 5.1-5.5) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Hands-on Coding through compilation. |

**Module – 3** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Objects and Classes:** Objects as data types, constructors, destructors, overloaded constructors. (Text 1: 6.1-6.3)<br>**Arrays:** arrays as class member data types, passing arrays, arrays as objects, strings, arrays of strings. (Text 1: 7.1-7.4)<br>**Operator Overloading:** Over loading of unary operators, binary operators, data conversion. (Text 1: 8.1-8.3) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Hands-on Coding through compilation. |

**Module – 4** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Inheritance:** Inheritance, derived class and base class, overriding member functions, scope resolution, levels of inheritance, multiple inheritances. (Text 1: 9.1-9.2, 9.4-9.5) Pointers: Pointers, Pointers to objects, virtual functions, friend functions, Static functions, files and streams, input/output operations. (Text 1: 10.1-10.3) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Visual Aids, Hands-on Coding through compilation. |

**Module – 5** **08 Hours (RBT Levels: L1,L2 & L3)**

| |
|---|
| **Streams & Files:** stream class, advantages of streams, stream class hierocracy. File systems : Disc file IO with streams, formatted file IO, character IO, Binary IO, closing of files, (Text 1: 12.1,12.2)<br>**Exception Handling:** Why do we need exception, exception syntax, simple exception handling examples, multiple exceptions. (Text 1: 14.3) |
| **Teaching-Learning Process:** |
| Chalk and talk method, PPTs, Visual Aids, Hands-on Coding through compilation. |

**Course Outcomes:**

1. Analyze the concepts of object-oriented programming and demonstrate various different data types, operators and control statements in a C++ program to solve problem.
2. Understand the concept of structures & functions in C++ program.
3. Create classes & Objects to develop C++ Program.
4. Discuss & illustrate the concepts of inheritance & pointers to design C++ Program.
5. Analyze and explore various Stream classes, I/O operations and exception handling.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks: | | | | |
| 1 | Object oriented programming in C++ | Robert Lafore | Galgotia Publications | 3rd edition 2003 |
| Reference Books: | | | | |
| 1 | Object Oriented Programming with C++ | E Balaguruswamy | Tata McGraw Hill | 3rd Edition 2006 |
| 2 | C++ Primer | Lippman& J. Lajoie | , Addison Wesley | 3rd Edition 2000 |
| 3 | The Complete Reference C++, Herbert Schildt | Herbert Schildt | Tata McGraw Hill | 4th Edition 2003 |

**E-Resources:**

1. https://www.tutorialspoint.com/cplusplus/index.htm

MOOCs: https://onlinecourses.nptel.ac.in/noc19_cs38/preview - NPTEL Course on Programming in C++ by Prof. Partha Pratim Das, IIT Kharagpur.

**List of Practical Experiments for Hands-on Practice:**

| SN | Experiments |
|---|---|
| 1 | Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min. |
| 2 | Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept. |
| 3 | Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students. |
| 4 | Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error |
| 5 | Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details. |
| 6 | Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function. |
| 7 | Write a C++ program to accept the student detail such as name & 3 different marks by get_data() method & display the name & average of marks using display() method. Define a friend function for calculating the average marks using the method mark_avg(). |
| 8 | Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & triangle respectively. |
| 9 | Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary& to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_ All_Allowances_IT). |
| 10 | Write a C++ program with different class related through multiple inheritance& demonstrate the use of different access specified by means of members variables & members functions. |
| 11 | Write a C++ program to create three objects for a class named count object with data members such as roll_no & Name. Create a members function set_data ( ) for setting the data values & display ( ) member function to display which object has invoked it using „this‟ pointer. |
| 12 | Write a C++ program to implement exception handling with minimum 5 exceptions classes including two built in exceptions. |

**Semester: IV**
**PROFESSIONAL SKILLS FOR THE WORK PLACE**

| | | | |
|---|---|---|---|
| Course Code | **22PSW47** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **30** | Total Marks | **100** |
| Credits | **1** | Exam Hours | **01** |

**Pre-requisites:**
1. Basic Conversational English
2. Fundamentals of Mathematics
3. Basic Knowledge of Reasoning

**Module – 1** **06 Hours**

**Communication Skills**
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

**Module – 2** **06 Hours**

**Presentation Skills**
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

**Module – 3** **06 Hours**

**Verbal & Numerical Ability**
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

**Module – 4** **06 Hours**

**English Language**
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors.

**Module – 5** **06 Hours**

**Verbal Ability and Verbal Reasoning**
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

**Course Outcomes:**
1. Demonstrate communicative ability in a professional environment
2. Articulate one's ideas and demonstrate them to an audience
3. Transform one's English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Reasoning N' Reasoning - Verbal & | Dr. Ravi Chopra | Galgotia | 1994 |

| | | | | |
|---|---|---|---|---|
| | Non-verbal Reasoning | | | |
| 2 | Magical Book on Quicker Math | M. Tyra | BSC | I Edition, 2018 |
| 3 | Communicate With Confidence | Diana Booher | Mc-Graw-Hill | Nov 2011 |
| **Reference Books** | | | | |
| 1 | Cambridge Advanced Learner's Dictionary | Cambridge University Press | CBS | IV Edition, 2013 |
| 2 | A Modern Approach to Verbal and Non-verbal Reasoning | R S Agarwal | S Chand | II Edition, 2018 |
| 3 | Word Power Made Easy | Norman Lewis | Goyal Publishers | IV Edition, 2014 |
| 4 | Speak With Confidence | Diana Booher | Mc-Graw-Hill | I Edition, 2002 |

**Semester: IV**
**UNIVERSAL HUMAN VALUES (UHV)**

| | | | |
|---|---|---|---|
| Course Code | **22UH48** | CIE Marks | **50** |
| Teaching Hours / Week (L: T:P: S) | **1:0:0:1** | SEE Marks | **50** |
| Total Hours of Pedagogy | **15 hour Theory Session +15 hour Self study** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01 Hour** |
| Examination type (SEE) | **SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions).** | | |

**Course objectives:**
This course is intended to:
1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evaluation.
7. Encourage the students for group work to improve their creative and analytical skills.

**Module-1** **03 hours**

| |
|---|
| **Introduction to Value Education:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations |

**Module-2** **03 hours**

| |
|---|
| **Harmony in the Human Being :** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health |

**Module-3** **03 hours**

| |
|---|
| **Harmony in the Family and Society :** |

| |
|---|
| Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order |

**Module-4** **03 hours**

| |
|---|
| **Harmony in the Nature / Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence |

**Module-5** **03 hours**

| |
|---|
| **Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession |

**Course Outcome (Course Skill Set)**

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**Expected to positively impact common graduate attributes like:**

- Ethical human conduct
- Socially responsible behaviour
- Holistic vision of life
- Environmentally responsible work
- Having Competence and Capabilities for Maintaining Health and Hygiene

**Appreciation and aspiration for excellence (merit) and gratitude for all**
**Suggested Learning Resources:**
**Books for READING:**
Text Book and Teachers Manual
- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
- The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

**Reference Books:**
- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews

**Semester: IV**
**Course Name: ADDITIONAL MATHEMATICS-II**
**(For Lateral Entry Students)**

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP41** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **0** | Exam Hours | **-** |

**Pre-requisites:**
1. Differentiation
2. Integration
3. Trigonometric formulae
4. Differential equations

**Module – 1** **08 Hours**

**Higher Order ODE's**
Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$
**Self-Study:** Finding particular Integral for $\phi(x) = x^m$

**Module – 2** **08 Hours**

**Partial Differential Equations (PDE's):**
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDE involving derivative with respect to one independent variable only.
**Self-Study:** Method of separation of variables

**Module – 3** **08 Hours**

**Laplace Transform:**
Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t), t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.
Inverse Laplace Transform: Definition, Inverse Laplace Transform of standard functions. Inverse transform by Partial Fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.
**Self-Study:** Convolution Theorem.

**Module – 4** **08 Hours**

**Numerical Methods:**
Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.
Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula without proof problems.
**Numerical Integration:** Simpson's $1/3^{rd}$ and $3/8^{th}$ rule (without proof) - problems.
**Self-Study:** Weddle's Rule

**Module – 5** **08 Hours**

**Probability:**
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem. Problems.
**Self-Study:** Applications of Bayes' theorem

**Course outcomes:**

1. Upon completion of this course, student will be able to,
2. Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
3. Construct a variety of partial differential equations and solution by various methods.
4. Use Laplace Transform and inverse Laplace Transform in solving differential /integral equation arising in network analysis, control systems and other fields of engineering
5. Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
6. Use the concepts of probability in different probability distribution.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43$^{rd}$ Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | Jhon willy & Sons | 10$^{th}$ Ed. (Reprint) 2016 |
| 3 | Additional Mathematics-2 | Dr. Pandurangappa | Sanguine Technical Publishers | 4$^{Th}$ Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V.Ramana | Tata McGraw-Hill | 11$^{th}$ Edition.2010 |

# ASSESSMENT DETAILS FOR 2022-23 SCHEME

**1. Integrated professional Core Courses (IPCC):**

**CIE for the Theory Component of IPCC:** **30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| **X** | **Total Marks for theory component A+B** | | | **30** |

**CIE for the LAB component of IPCC:** **20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**2. Professional Core / Basic Science /ESC/ETC/PLC courses (Theory): Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B) = 30 + 20 = 50**

**Semester End Examination (SEE)**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE.
- Marks secured will be scaled down to 50.

**3. Professional Core Course (PCC) Lab/Ability Enhancement course (Lab): Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**

- All laboratory experiments are to be included for practical examination
- Students can pick one experiment from the lot with equal choice to all the students in a batch.
- Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
- Marks distribution: Procedure (15%) + Execution (70%) + Viva Voce (15%)

**4. Ability Enhancement Course (AEC)/Skill Enhancement course (SEC) (Theory) , Universal human values Course (22UH48):**

**Assessment Details of CIE**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

**SEE Guidelines for the Courses**

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

**Suggested Alternate Assessment Tools for PCC, IPCC and AEC Courses:**

- Quiz
- Assignments
- Seminars / Presentations
- Paper Publications
- Mini Projects
- MOOCs
- Industrial Visits and Report Writing
- Self-learning with Certifications and
- Cooperative and problem based learning.

**No SEE for the Courses: Social Connect and Responsibility (22SC37), NSS, YOGA, Sports and Athletics.**

** ** **

# Scheme of Teaching and Evaluation for B.E III & IV Semester Electrical & Electronics Engineering Program (2022 Scheme)

## *Categories of courses for B.E.( 2022 scheme)*

| SN | Course Area | Credit Distribution |
|---|---|---|
| 1. | Humanities Social Sciences including Management (HS) | **09** |
| 2 | Basic Sciences (BS) | **20** |
| 3. | Engineering Sciences (ES) | **26** |
| 4. | Professional Core (PC) | **54** |
| 5. | Professional Electives (PE) | **12** |
| 6. | Ability Enhancement Course(AEC) | **8** |
| 7. | Open Electives | **9** |
| 8. | Project Work(Mini/Major) | **10** |
| 9. | Internship(INT) | **10** |
| 10. | Universal Human Values(UHV) | **2** |
| 11. | Mandatory Non-Credit Course (MNC) | **0** |
| | **Total** | **160** |

## CREDIT DISTRIBUTION FOR B.E. PROGRAMME

| SEM | HS | BS | ES | PC | PE | AEC | OE | PW | INT | UHV | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | 20 |
| 2 | 2 | 7 | 10 | - | - | 1 | - | - | - | - | 20 |
| 3 | | 3 | 3 | 12 | | 1 | | | | 1 | 20 |
| 4 | | 3 | 3 | 12 | | 1 | | | | 1 | 20 |
| 5 | 5 | | | 9 | 3 | 1 | | 2 | | | 20 |
| 6 | | | | 9 | 3 | 3 | 3 | 2 | | | 20 |
| 7 | | | | 12 | 3 | | 3 | 6 | | | 24 |
| 8 | | | | | 3 | | 3 | | 10 | | 16 |
| TOTAL | 9 | 20 | 26 | 54 | 12 | 8 | 9 | 10 | 10 | 2 | 160 |

# III SEMESTER

| SN | Course and Course Code | | Course Title | Teaching Department (TD) & QP Setting Board (PSB) | Teaching Hours /Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | SDA (S) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BSC | 22BB31 | Biology for Engineers | CHEM | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | 22EE32 | Digital Electronics | EEE | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 22EE33 | Analog Electronic Circuits | EEE | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCC | 22EE34 | Electrical Machines - I | EEE | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 5 | PCCL | 22EEL35 | Electrical Machines Lab - I | EEE | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 6 | ESC | 22ESC361 | Electric Circuit Analysis | EEE | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 7 | UHV | 22SC37 | Social Connect and Responsibility | Any Department | 0 | 0 | 2 | | 01 | 100 | --- | 100 | 1 |
| 8 | AEC | 22AEE381 | Ability Enhancement Course Circuit Laboratory using Pspice | EEE | If the course is a Theory: 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| | | | | | If a course is a laboratory: 0 | 0 | 2 | | 02 | | | | |
| 9 | MC | 22NS39 | National Service Scheme (NSS) | NSS Coordinator | 0 | 0 | 2 | | | 100 | --- | 100 | 0 |
| | | 22PE39 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | 22YO39 | Yoga | Yoga Teacher | | | | | | | | | |
| Total | | | | | | | | | | 550 | 350 | 900 | 20 |

| Course prescribed to lateral entry Diploma holders admitted to III semester B.E. / B.Tech programs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | NCMC | 22MATDIP31 | Additional Mathematics - I | Mathematics | 3 | 0 | 0 | | | -- | 100 | -- | 100 |

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credits for IPCC are 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE

| Engineering Science Course (ESC/ETC/PLC) |
|---|
| Electrical Circuit Analysis |

| Ability Enhancement Course – III |
|---|
| 1.Circuit Laboratory Using Pspice |
| 2.Electrial Machines-I using SCILAB |

## IV SEMESTER

<table>
<tr><th rowspan="3">SN</th><th rowspan="3" colspan="2">Course and Course Code</th><th rowspan="3">Course Title</th><th rowspan="3">Teaching Department (TD) & QP Setting Board (PSB)</th><th colspan="4">Teaching Hours /Week</th><th colspan="4">Examination</th><th rowspan="3">Credits</th></tr>
<tr><th>Theory Lecture</th><th>Tutorial</th><th>Practical/ Drawing</th><th>Self -Study</th><th rowspan="2">Duration in hours</th><th rowspan="2">CIE Marks</th><th rowspan="2">SEE Marks</th><th rowspan="2">Total Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>S</th></tr>
<tr><td>1</td><td>BSC</td><td>22MEE41</td><td>Applied Mathematics for Electrical and Electronics Engineering</td><td>MATHS</td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>2</td><td>IPCC</td><td>22EE42</td><td>Power Electronics</td><td>EEE</td><td>3</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>3</td><td>PCC</td><td>22EE43</td><td>Electrical Machines - II</td><td>EEE</td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>4</td><td>IPCC</td><td>22EE44</td><td>Microcontroller</td><td>EEE</td><td>3</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>5</td><td>PCCL</td><td>22EEL45</td><td>Electrical Machines Lab - II</td><td>EEE</td><td>0</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td>6</td><td>ESC</td><td>22ESC461</td><td>Electrical and Electronics Measurements</td><td>EEE</td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">AEC/ SEC</td><td rowspan="4">22PSW47</td><td rowspan="4">Professional Skills for the Work Place</td><td rowspan="4">TD and PSB: Concerned department</td><td colspan="4">If the course is Theory</td><td rowspan="2">01</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="4">100</td><td rowspan="4">1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td></tr>
<tr><td colspan="4">If the course is a lab</td><td rowspan="2">02</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td></td></tr>
<tr><td>8</td><td>UHV</td><td>22UH48</td><td>Universal human values course</td><td>Any Department</td><td>1</td><td>0</td><td>0</td><td></td><td>01</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">MC</td><td>22NS49</td><td>National Service Scheme (NSS)</td><td>NSS coordinator</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">2</td><td></td><td></td><td rowspan="3">100</td><td rowspan="3">--</td><td rowspan="3">100</td><td rowspan="3">0</td></tr>
<tr><td>22PE49</td><td>Physical Education (PE) (Sports and Athletics)</td><td>Physical Education Director</td><td></td><td></td></tr>
<tr><td>22YO49</td><td>Yoga</td><td>Yoga Teacher</td><td></td><td></td></tr>
<tr><td colspan="10">Total</td><td>500</td><td>400</td><td>900</td><td>20</td></tr>
</table>



<table>
<tr><th colspan="14">Course prescribed to lateral entry Diploma holders admitted to III semester B.E. / B.Tech programs</th></tr>
<tr><td>10</td><td>NCMC</td><td>22MATDIP41</td><td>Additional Mathematics - II</td><td>Mathematics</td><td>3</td><td>0</td><td>0</td><td></td><td></td><td>--</td><td>100</td><td>--</td><td>100</td></tr>
</table>

# III Semester

**Semester: III / IV**
**BIOLOGY FOR ENGINEERS**

| | | | |
|---|---|---|---|
| Course Code | **22BB31 / 41** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P: S) | **3:0:0:** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **3** |
| Examination type (SEE) | **Theory** | | |

**Course objectives:**
- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

**Teaching-Learning Process (General Instructions)**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning / inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical / hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR / VR / MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical / hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) / oral presentations.

**Module-1** **08 Hours**

| |
|---|
| **INTRODUCTION TO BIOLOGY:** The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones. |

**Module-2** **08 Hours**

| |
|---|
| **BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):** Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents / detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching). |

**Module-3** **08 Hours**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):**
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

**Module-4** **08 Hours**

**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):**
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

**Module-5** **08 Hours**

**TRENDS IN BIOENGINEERING (QUALITATIVE):**
Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

**Course outcome (Course Skill Set)**
At the end of the course, the student will be able to :
1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

**Suggested Learning Resources:**
**Books**

- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016


**Web links and Video Lectures (e-Resources):**

- https: / / nptel.ac.in / courses / 121106008
- https: / / freevideolectures.com / course / 4877 / nptel-biology-engineers-other-non-biologists
- https: / / ocw.mit.edu / courses / 20-020-introduction-to-biological-engineering-design-spring-2009
- https: / / ocw.mit.edu / courses / 20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https: / / www.coursera.org / courses?query=biology
- https: / / onlinecourses.nptel.ac.in / noc19_ge31 / preview
- https: / / www.classcentral.com / subject / biology
- https: / / www.futurelearn.com / courses / biology-basic-concepts

**Activity Based Learning (Suggested Activities in Class) / Practical Based learning**

- Group Discussion of Case studies
- Model Making and seminar / poster presentations
- Design of novel device / equipment like Cellulose-based water filters, Filtration system

**Semester: III**
**Course Name: Digital Electronics**

| | | | |
|---|---|---|---|
| Course Code (IPCC) | **22EE32** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Credits | **04** | Exam Hours | **03** |
| Total Hours of Pedagogy | **50** | Total Marks | **100** |

**Pre-requisites:**
- Number Systems
- Basic Arithmetic operations
- Boolean Algebra, theorems, formulas and functions
- Basic operation of logic gates and realization using basic gates
- Basic operations and applications of Flip-flop, shift register and counters

**Module – 1** **08 hours**

**Principles of Combinational Logic:** Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don‘t care terms), Simplifying minterm, Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don‘t care terms.

**Module - 2** **08 hours**

**Analysis and Design of Combinational logic:** General approach to combinational logic design, Decoders, BCD decoders, Encoders using decoders and encoders as function generators, digital multiplexers, demultiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.

**Module – 3** **08 hours**

**Flip-Flops:** Basic Bi-stable elements, Latches, Timing considerations, Operation and truth table of SR, JK, T and D flip-flops. The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops. Edge triggered D flip- flops, Characteristic equations.

**Module – 4** **08 hours**

**Applications of Flip-Flops:** Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counter, Design of a synchronous mod-n counter using clocked T, JK, D and SR flip-flops.

**Module – 5** **08 hours**

**Sequential Circuit Design:** Mealy and Moore models, difference between Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams.

**PRACTICAL COMPONENT OF IPCC**

| SN | List of Experiments |
|---|---|
| 1 | Simplification, realization of Boolean expressions using logic gates/Universal gates. |
| 2 | Realization of Half/Full adder and Half / Full Subtractors using logic gates. |
| 3 | Realization of parallel adder / Subtractors using IC7483 |
| 4 | Realization of Binary to Gray code conversion and vice-versa. |
| 5 | Realization of One/Two bit comparator and study of IC7485 magnitude comparator. |
| 6 | Truth table verification of Flip-Flops: SR, JK, D and T (Using Universal gates). |
| 7 | Design and testing Ring counter/Johnson counter. |
| 8 | Realization of a synchronous MOD – N counter design using IC7476, IC7490, IC74192/193. |

**Course Outcomes:**

1. **Analyze** combinational logic circuits and minimization techniques.
2. **Implement** Adder, Subtractor, Decoder, Encoders, Binary Comparators, Multiplexers, Demultiplexers and Code Converter.
3. **Analyze** Latches and Flip-Flops.
4. **Design** Counters and Shift registers using Flip-Flops.
5. **Illustrate** Melay, Moore Models and state diagrams for the given clocked sequential circuits.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| **1** | Digital Logic Applications and Design | John M Yarbrough | Thomson Learning | 2001 |
| **2** | Digital Principles and Design | Donald D. Givone | McGraw Hill Education | Indian Edition, 2002 |
| **Reference Books** | | | | |
| **1** | Digital Design | Morris Mano | Prentice Hall of India | Third Edition |
| **2** | Digital Circuits and Design | D. P.Kothari and J. S Dhillon | Pearson | 2016 |

**Semester: III**
**Course Name: Analog Electronic Circuits**

| | | | |
|---|---|---|---|
| Course Code (IPCC) | **22EE33** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Credits | **04** | Exam Hours | **03** |
| Total Hours of Pedagogy | **50** | Total Marks | **100** |

**Pre-requisites:**
- Basics of Semiconductors
- Transistor and Diode operation
- KVL and KCL

**Module – 1** **08 hours**

**Diode Circuits:** Diode characteristics, Diode clipping, and clamping circuits.
**BJT analysis:** The operating point, load line analysis, DC analysis and design of fixed bias circuit, emitter stabilized bias circuit, collector to base bias circuit, voltage divider bias circuit.
Bias stabilization and stability factors for fixed bias circuit, collector to base bias circuit and voltage divider bias circuit, Transistor switching circuits.

**Module - 2** **08 hours**

**Transistor at Low Frequencies:** BJT transistor modelling, CE fixed bias configuration, voltage divider bias, emitter follower, CB configuration, collector feedback configuration, analysis using h – parameter model. Miller’s theorem and its dual.
**Transistor frequency response:**
General frequency considerations, effect of various capacitors on frequency response, Miller effect capacitance, high frequency response.

**Module – 3** **08 hours**

**Multistage Amplifiers:** Cascade and cascode connections, Darlington circuits, analysis and design.
**Feedback Amplifiers:** Classification of feedback amplifiers, concept of feedback, general characteristics of negative feedback amplifiers, Input and output resistance with feedback of various feedback amplifiers.

**Module – 4** **08 hours**

**Power Amplifiers:** Classification, analysis and design of Class A – Directly Coupled and Transformer Coupled, Class B- Complementary Symmetry and Push Pull, Class C and Class AB. Distortion in power amplifiers, second harmonic distortion.
**Oscillators:** Concept of positive feedback, frequency of oscillation for RC phase oscillator, Wien Bridge oscillator, Tuned oscillator circuits, Hartley oscillator, Colpitt’s oscillator, crystal oscillator. (Derivation excluded)

**Module – 5** **08 hours**

**FETs:** Construction, working and characteristics of JFET and MOSFET(enhance and Depletion type) Biasing of JFET and MOSFET. Fixed bias configuration, self bias configuration, voltage divider biasing. Analysis and design of JFET (only common source configuration with fixed bias) and MOSFET amplifiers.

## PRACTICAL COMPONENT OF IPCC

| SN | Experiments |
|---|---|
| 1 | Experiments on clippers and clampers |
| 2 | Testing of Half wave rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency. |
| 3 | Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency. |
| 4 | Frequency response of single stage BJT RC coupled amplifier and determination of half power points, bandwidth. |
| 5 | Design and testing of BJT -RC phase shift oscillator for given frequency of oscillation. |
| 6 | Design and testing of Crystal oscillator for given frequency of oscillation |
| 7 | Design and testing of Hartley and Colpitt's oscillator for given frequency of oscillation |
| 8 | Frequency response of BJT Darlington emitter follower |
| 9 | Frequency response of transformer less Class B push pull amplifier |
| 10 | Design and simulation of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter using MATLAB. Determination of ripple factor, regulation and efficiency. |

**Course Outcomes:**

1. **Analyze** different diode and transistor circuits.
2. **Analyze** the operation of transistor at low frequencies.
3. **Derive** frequency of oscillations, input and output impedances of amplifier circuits.
4. **Analyze** different power amplifiers and oscillators.
5. **Analyze** and design JFETs and MOSFETs.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Electronic Devices and Circuit Theory | Robert L Boylestad, Louis Nashelsky | Pearson | 11th Edition, 2015. |
| 2 | Electronic Devices and Circuits | Millman and Halkias | Mc Graw Hill | 4th Edition, 2015 |
| 3 | Electronic Devices and Circuits | David A Bell | Oxford University Press | 5th Edition, 2008 |
| **Reference Books** | | | | |
| 1 | Microelectronics Circuits Analysis and Design, | Muhammad Rashid | Cengage Learning | 2nd Edition, 2014 |
| 2 | Electronic Devices and Circuits | Anil K. Maini, VashaAgarval | Wiley | 1st Edition, 2009 |
| 3 | Electronic Devices and Circuits | S. Salivahanan, Suresh | Mc Graw Hill | 3rd Edition, 2013 |

**Semester: III**
**Course Name: Electrical Machines – I (Transformers & Generators)**

| | | | |
|---|---|---|---|
| Course Code | **22EE34** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**

- Transformer construction, types and working.
- 1-Ø supply and 3-Ø supply, phase current and line current, phase voltage and line voltage.
- Relation between voltage and current for resistive, inductive and capacitive loads.
- Types of power factor, active and reactive power.
- Construction and working of DC generator and synchronous generator.

**Module – 1** **08 hours**

**Single phase Transformers:** Operation of practical transformer under no-load and on-load with phasor diagrams. Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency. Voltage regulation and its significance. All-day(Energy) efficiency. **Three-phase Transformers:** Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation– star/star, delta/delta, star/delta, zigzag/star and V/V, comparative features. Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, vector groups.

**Module - 2** **08 hours**

**Transformer Tests:** Polarity test, Sumpner's test, separation of hysteresis and eddy current losses. **Parallel Operation of Transformers:** Necessity and conditions for parallel operation– Single phase and three phase. Load sharing in case of similar and dissimilar transformers. **Auto transformers and Tap changing transformers:** Introduction to autotransformer-copper economy, equivalent circuit, no load and on load tap changing transformers.

**Module – 3** **08 hours**

**Three-Winding Transformers & Cooling of Transformers**: Three-winding transformers. Cooling of transformers.
**Direct current Generator:** Armature reaction, Commutation and associated problems, **Synchronous Generators:** Armature windings, winding factors, e.m.f equation. Harmonics–causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit.

**Module – 4** **08 hours**

**Voltage regulation methods of synchronous generators:** Alternator on load. Voltage regulation. Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, synchronous reactance, Voltage regulation by EMF, MMF, ZPF and ASA methods.

**Module – 5** **08 hours**

**Parallel operation of synchronous generator:** Necessity and conditions for synchronization of alternator, synchronizing to infinite bus bars, load sharing. Methods of Synchronization, Synchronizing power.
**Performance of Synchronous Generators:** Effects of saliency, two-reaction theory, Determination of $X_d$ & $X_q$– slip test, Hunting and damper windings.

**Course Outcomes:**

1. **Determine** the efficiency, voltage regulation and equivalent circuit constants of a 1-phase transformer from O.C and S.C test.
2. **Compare** the types of 3-phase transformer connections (bank) with respect to advantages, disadvantages and applications.
3. **Analyze** the performance characteristics of D.C. generator and synchronous generators
4. **Determine** the voltage regulation of a synchronous generator by EMF, MMF and ZPF methods.
5. **Analyze** the parallel operation of 1-phase transformer and synchronous generator.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Electric Machines | D. P. Kothari, et al | McGraw Hill | 4th edition 2011 |
| 2 | Electric Machines | Ashfaq Hussain | Dhanpat Rai & Co | 2nd edition, 2013 |
| 3 | Electrical Technology | B.L Theraja | S.Chand,Vol.2 | 23rd edition 2002 |
| **Reference Books** | | | | |
| 1 | Electrical Technology | J B Gupta | Pustak Kosh | 2nd edition |
| 2 | Theory of Alternating Current Machines | Alexander Langsdorf | McGraw Hill | 2nd Edition, 2001 |
| 3 | Principals of Electrical Machines | V.K Mehta, Rohit Mehta | S Chand | 2nd edition, 2009 |
| 4 | Electrical Machines | S.K. Sahadev | Cambridge University Press | ISBN:978-7-108-43106-4. |

**Semester: III**
**Name of the Laboratory: Electrical Machines Laboratory – I**

| | | | |
|---|---|---|---|
| Course Code | **22EEL35** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**List of Experiments:**

| SN | Experiments |
|---|---|
| 1 | Open Circuit and Short circuit tests on 1-Φ transformer and pre determination of (i) Efficiency (ii) % of Regulation (iii) Calculation of equivalent circuit parameters. |
| 2 | Sumpner's test on similar transformers and determination of combined and individual transformer efficiency. |
| 3 | Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load. |
| 4 | Ratio and Polarity test on single-phase transformer. |
| 5 | Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load. |
| 6 | Scott connection with balanced and unbalanced loads. |
| 7 | Separation of hysteresis and eddy current losses in single phase transformer. |
| 8 | Voltage regulation of an alternator by EMF and MMF methods. |
| 9 | Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines. |
| 10 | Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa. |
| | **Open ended Experiments** |
| 1 | Determination of efficiency and voltage regulation of a 1-phase transformer by direct loading. |
| 2 | Determination of sequence impedances of synchronous generators. |

**Course outcomes:**

1. **Determine** the efficiency, voltage regulation and equivalent circuit constants of a 1-Φ transformer by conducting O.C and S.C tests.
2. **Perform** parallel operation of two different kVA transformers to determine the load shared by each transformer.
3. **Conduct** experiments on 3-phase transformer connections (Bank) to determine the efficiency.
4. **Determine** voltage regulation of a 3-phase synchronous generator using EMF and MMF methods by conducting O.C and S.C tests.
5. **Analyze** the performance of synchronous generator by connecting it to the infinite bus bar.

**Semester: III**
**Course Name: Electric Circuit Analysis**

| | | | |
|---|---|---|---|
| Course Code (ESC) | **21ESC361** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Basics of Calculus, trigonometry, complex numbers
- Electromagnetism
- Concepts of Electric current, voltage and power
- Series & parallel circuits

**Module – 1** **08 hours**

**Basic Concepts:** Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for AC and DC circuits with independent and dependent sources (iii) Super-Mesh and Super node analysis.

**Module - 2** **08 hours**

**Network Theorems:** Super Position theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Millman's theorem. Analysis of networks with and without dependent AC and DC sources.

**Module – 3** **08 hours**

**Network topology:** Graph of a network, concepts of: tree & co-tree, incidence matrix, tie-set & cut-set schedules, Principle of duality.
**Resonant Circuits:** Analysis of simple series RLC and parallel RLC circuits under resonances. Problems on Resonant frequency, Bandwidth and Quality factor at resonance.

**Module – 4** **08 hours**

**Transient Analysis:** Transient analysis of RL and RC circuits under DC excitations: Behaviour of circuit elements under switching action, Evaluation of initial conditions.
**Laplace Transformation:** Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems.

**Module – 5** **08 hours**

**Two Port networks**: Definition, Open circuit impedance, Short circuit admittance, hybrid and Transmission parameters and their evaluation for simple circuits, relationships between parameter sets, interconnection of two-port networks.

**Course Outcomes:**

1. **Simplify** the network complexity using basic concepts, basic laws and various reduction techniques.
2. **Solve** complex electric circuits using network theorems.
3. **Discuss** series, parallel resonant circuits and network duality.
4. **Evaluate** transient response of electric circuits and synthesize typical waveforms using Laplace transformation.
5. **Analyze** the parameters of two port networks.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Engineering Circuit Analysis | William H Hayt. et al | McGraw Hill | 8th Edition,2014 |
| 2 | Network Analysis | M.E. Vanvalkenburg | Pearson | 3rd Edition,2014 |
| **Reference Books** | | | | |
| 1 | Fundamentals of Electric Circuits | Charles K Alexander<br>Matthew N O Sadiku | McGraw Hill | 5th Edition, 2013. |

**Semester: III**
**SOCIAL CONNECT & RESPONSIBILITY**

| | | | |
|---|---|---|---|
| Course Code | **22SC37** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P: S) | **0:0:2** | SEE Marks | **--** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (No SEE – Only CIE) | **For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept. / Any Dept.** | | |
| Credits | **01 – Credit** | | |

**Course objectives:**
The course will enable the students to:
1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Contents:**
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

**In the following a set of activities planned for the course have been listed:**

| **Contents** |
|---|
| **Part I:**<br>**Plantation and adoption of a tree:**<br>Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. |
| **Part II :**<br>**Heritage walk and crafts corner:**<br>Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes. |
| **Part III :**<br>**Organic farming and waste management:**<br>Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – |
| **Objectives, Visit, Case Study, Report, Outcomes.**<br>**Part IV:**<br>**Water conservation:**<br>Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.<br><br>**Part V :**<br>**Food walk:** |

| |
|---|
| City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes. |

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Communicate and connect to the surrounding.
CO2: Create a responsible connection with the society.
CO3: Involve in the community in general in which they work.
CO4: Notice the needs and problems of the community and involve them in problem –solving.
CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Activities:**
Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**PEDAGOGY:**
The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs / social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

**COURSE TOPICS:**
The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

**DURATION:**
A total of 40 - 50 hours engagement per semester is required for the 3rd semester of the B.E. / B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

**Guideline for Assessment Process:**

**Continuous Internal Evaluation (CIE):**

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor / s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and / or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

**Excellent:** **80 to 100**
**Good:** **60 to 79**
**Satisfactory:** **40 to 59 Unsatisfactory and fail : <39**

**Special Note:**

**NO SEE – Semester End Exam – Completely Practical and activities based evaluation**

**Pedagogy – Guidelines:**

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

| SN | Topic | Group size | Location | Activity Execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Plantation and adoption of a tree: | May be individual or team | Farmers land / parks / Villages / roadside / community area / College campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 2. | Heritage walk and crafts corner: | May be individual or team | Temples / monumental places / Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 3. | Organic farming and waste management: | May be individual or team | Farmers land / parks / Villages visits / roadside / community area / College campus etc. | Group Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 4. | Water conservation: & conservation techniques | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Site Selection / Proper Consultation / Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |
| 5. | Food walk: Practices in society | May be individual or team | Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc. | Group Selection / Proper Consultation A/ Continuous Monitoring / Information Board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by Faculty |

**Plan of Action (Execution of Activities)**

| SN | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study based Assessment, Individual performance |
| 9 | Sector / Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities, compiled report should be submitted as per the instructions and scheme.

**Semester: III**

**Name of the Laboratory: Circuit Laboratory using Pspice (Ability Enhancement Course)**

| | | | |
|---|---|---|---|
| AEC Course Code | **22AEE381** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**List of Experiments:**

| SN | Experiments |
|---|---|
| 1 | Simulation and verification of Kirchhoff's Current Law & Kirchhoff's Voltage Law. |
| 2 | Simulation and verification of Super Position theorem. |
| 3 | Simulation and verification of Reciprocity theorem. |
| 4 | Simulation and verification of Thevenin's and Norton's theorem. |
| 5 | Simulation and verification of Maximum Power Transfer theorem. |
| 6 | Simulation and verification of Millman's theorem. |
| 7 | Simulation and analysis of resonant circuits. |

**Course outcomes:**

1. **Analyze** Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. **Verify** Super Position theorem.
3. **Analyze** Reciprocity theorem.
4. **Verify** Thevenin's and Norton's theorem.
5. **Analyze** Maximum Power Transfer theorem, Millman's theorem Resonant circuits.

**Semester: III**
**NATIONAL SERVICE SCHEME (NSS) - (3rd to 6th)**

| | | | |
|---|---|---|---|
| Course Code | **22NS39** | CIE Marks | **100** |
| Teaching Hours / Week (L:T:P) | **0:0:3** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40 hour Practical Session +15 hour Planning** | Total Marks | **100** |
| Examination nature (SEE) | Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th Semester) | | |
| Credits | NCMC – Non Credit Mandatory Course<br>(Completion of the course shall be mandatory for the award of degree) | | |

**Course objectives:**
National Service Scheme (NSS) will enable the students to:
1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**General Instructions - Pedagogy:**
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

**National Service Scheme (NSS) – Contents:**
1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

**NOTE:**

- Student / s in individual or in a group should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

**Semester wise from 3rd to 6th semester**
**DISTRIBUTION OF ACTIVITIES**

| Semester | Topics / Activities to be Covered |
|---|---|
| 3rd Sem. | 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.<br>2. Waste management– Public, Private and Govt organization, 5 R's.<br>3. Setting of the information imparting club for women leading to contribution in social and economic issues. |
| 4th Sem. | 4. Water conservation techniques – Role of different stakeholders– Implementation.5<br>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.<br>6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. |
| 5th Sem. | 7. Developing Sustainable Water management system for rural areas and implementation approaches.<br>8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,<br>9. Spreading public awareness under rural outreach programs.(minimum5 programs).<br>10. Social connect and responsibilities. |
| 6th Sem. | 11. Plantation and adoption of plants. Know your plants.<br>12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).<br>13. Govt. school Rejuvenation and helping them to achieve good infrastructure. |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.**

| SN | Topic | Group size | Location | Activity execution | Reporting | Evaluation Of the Topic |
|---|---|---|---|---|---|---|
| 1. | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers Land / Villages / Roadside / Community Area / College Campus Etc., | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 2. | Waste management– Public, Private and Govt. organization, 5 R's. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,, | Site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 3. | Setting of the information imparting club for women leading to contribution in social and economic issues. | May be individual or team | Women Empowerment Groups / Consulting NGOs & Govt. Teams / College Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 4. | Water conservation techniques – Role of different stakeholders– Implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 5. | Preparing an actionable business proposal for enhancing the village income and approach for implementation. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 6. | Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education. | May be individual or team | Local Government / Private / Aided Schools / Government Schemes Officers / Etc., | School selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 7. | Developing Sustainable Water management system for rural areas and implementation approaches. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | site selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. | Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc., | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 9. | Spreading public awareness under rural outreach programs (minimum5 programs) / Social connect and responsibilities. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Group selection / pro per consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 10. | Plantation and adoption of plants. Know your plants. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 11. | Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs). | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 12. | Govt. school Rejuvenation and helping them to achieve good infrastructure. | May be individual or team | Villages / City Areas / Grama Panchayat / Public Associations / Government/ Schemes Officers / Campus Etc., | Place selection / proper consultation / Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

**Plan of Action (Execution of Activities for Each Semester)**

| SN | Practice Session Description |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

**Course outcomes (Course Skill Set):**
At the end of the course, the student will be able to:
CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems / issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.
CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**SUGGESTED LEARNING RESOURCES:**
**Books:**
**NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
Government of Karnataka, NSS cell, activities reports and its manual.
Government of India, NSS cell, Activities reports and its manual.

**Semester: III**
**PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I**

| | | | |
|---|---|---|---|
| Course Code | **22PE39** | CIE | **100 Marks** |
| Credits: L:T:P | **0:0:2** | | |
| Total Hours | **30 P** | | |

**Course Outcomes:**
At the end of the course, the student will be able to
1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional / state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

**Module I: Orientation** **05 Hours**

a. Lifestyle
b. Fitness
c. Food & Nutrition
d. Health & Wellness
e. Pre-Fitness test.

**Module II: General Fitness & Components of Fitness** **15 Hours**

a. Warming up (Free Hand exercises)
b. Strength – Push-up / Pull-ups
c. Speed – 30 Mtr Dash
d. Agility – Shuttle Run
e. Flexibility – Sit and Reach
f. Cardiovascular Endurance – Harvard step Test

**Module III: Recreational Activities** **10 Hours**

a. Postural deformities.
b. Stress management.
c. Aerobics.
d. Traditional Games.

**Semester III**
**YOGA FOR A BETTER LIFE (3rd to 6th)**

| | | | |
|---|---|---|---|
| Course Code | **22YO39** | CIE Marks | 100 / Sem. |
| Teaching Hours / Week (L:T:P) | **0:0:2** | SEE Marks | --- |
| Total Hours of Pedagogy per semester | **24 - 28 hours (Theory + practical)** | Total Marks | 100 / Sem. |
| Examination nature (SEE): | **Objective type Theory / Practical / Viva-Voce** | | |

**Course objectives:**
1. To enable the student to have good health.
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.
5. To attain higher level of consciousness.

**The Health Benefits of Yoga**
The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

  The system has been advocated as a complementary treatment to aid the healing of several ailments such as
- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

  The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

  If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system

- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills

- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

**Semester: III**
**Course Name: ADDITIONAL MATHEMATICS-I**
**(For Lateral Entry Students)**

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP31** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **00** | Exam Hours | **-** |

**Pre-requisites:**
1. Algebraic formulae
2. Differentiation
3. Integration
4. Trigonometric formulae

**Module – 1** **08 Hours**

**Linear Algebra**
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.
**Self-Study:** Gauss Jordon Method

**Module - 2** **08 Hours**

**Differential Calculus:**
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
**Self-Study:** Taylor's series expansion.

**Module – 3** **08 Hours**

**Vector Differentiation:**
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and Vector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields-Problems.
**Self-Study:** Angle between two surfaces [RBT Levels: L1, L2,L3]

**Module – 4** **08 Hours**

**Integral Calculus:**
Review of elementary integral calculus. Reduction formulae for $Sin^n x, Cos^n x$(with proof) and $Sin^m x\ Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
**Self-Study:** Change of Order of Integration.

**Module – 5** **08 Hours**

**Ordinary Differential Equations:**
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact. Linear differential equations and Bernoulli's equation.
**Self-Study:** Homogeneous differential equations

**Course outcomes:**

1. Upon Completion of this course, student will be able to,
2. Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.
3. Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
4. Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
5. Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
6. Solve first order linear differential equations analytically using standard methods.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43rd Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | John Willy & Sons | 10th Ed. (Reprint). 2016 |
| 3 | Additional Mathematics-1 | Dr. Pandurangappa | Sanguine Technical Publishers | 4th Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V. Ramana | Tata McGraw-Hill | 11th Edition.2010 |

# IV Semester

**Semester: IV**

**Course Name: Applied Mathematics for Electrical and Electronics Engineering**

| | | | |
|---|---|---|---|
| Course Code | **22MEE41** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**

- Knowledge of infinite series, trigonometry, calculus, analytical geometry, signals and systems properties.

**Course objectives:**

This course will enable students

1. To find the association between attributes and the correlation between two variables
2. To Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.
3. To explain Fourier Transform representation of signals and the properties of Fourier Transforms.
4. To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems.
5. To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains.

**Module – 1: Curve Fitting, Correlation and regressions** **08 Hours**
**(RBT Levels: L1, L2 and L3)**

Principles of least squares, Curve fitting by the method of least squares in the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ax^b$. Correlation, Co-efficient of correlation, lines of regression. Angle between regression lines, standard error of estimate, rank correlation.
**Applications**: To fit the given data into different curves
**Self-Study**: Fitting of curves in the form $y = ae^{bx}, y = ab^x$.

**Module – 2: Fourier series** **08 Hours**

Periodic functions, Dirichlet's condition, conditions for Fourier series expansion, Fourier series of functions with period $2\pi$, even and odd functions. Half range Fourier series. Practical harmonic analysis.
**Applications:** Problems on Fourier Series as applied to Signals and Systems
**Self- Study:** Fourier Series with arbitrary period.

**Module – 3: Fourier Transforms** **08 Hours**

Infinite Fourier Transforms: Definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Problems. DTFT and Inverse DTFT, Applications.
**Applications:** Problems on DTFT as applied to Signals and Systems
**Self-Study:** Properties of Fourier Transforms, sine & cosine Transforms.

**Module – 4: Z-Transforms** **08 Hours**

Introduction, Z-transform, properties of ROC, properties of Z-transforms. Inverse Z-transforms, method of partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations.
**Applications:** Solving Difference equations using Z-transforms
**Self-Study:** Method of Power series.

**Module – 5: Time - Domain representation for LTI Systems** **08 Hours**

Convolution sum and convolution integral, impulse response, properties, solution of differential and difference equations.
**Applications:** Problems on Convolution sum and convolution integrals as applied to signals and systems
**Self-Study:** Block diagram representation of LTI systems.

**Course Outcomes:**

1. Apply the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
2. Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
3. Use Fourier transforms to analyze problems involving continuous-time signals
4. Apply the continuous time Fourier transform, discrete time Fourier transform, z-Transform, to the analysis of LTI continuous and discrete-time systems
5. Solve differential equations and difference equations of system to determine response

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Text books** | | | | |
| 1 | Higher Engineering Mathematics | B. S. Grewal | Khanna Publications, 44 th Ed., | 2021 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | John Wiley & Sons, | 10 th Ed., 2018 |
| 3 | Signals & Systems | Simon Haykin, Berry Van Veen | Wiley | 2 nd Edition |
| **Reference Books** | | | | |
| 1 | Signals & Systems | Nagoor Kani | McGraw Hill | 1st Edition |
| 2 | Signals & Systems | H.P. Hsu, R Ranjan | Schaum's outline series, TMH | printed in 2005 |

**e-Resources:**
https://www.youtube.com/playlist?list=PLC210462711083C4

**Semester: IV**
**Course Name: POWER ELECTRONICS**

| | | | |
|---|---|---|---|
| Course Code (IPCC) | **22EE42** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Credits | **04** | Exam Hours | **03** |
| Total Hours of Pedagogy | **50** | Total Marks | **100** |

**Course objectives:**
1. To describe the construction, characteristics and applications of power electronics devices.
2. To compare the performance of various power semiconductor devices.
3. To analyze various turn on, turn off and protection methods of thyristors.
4. To design of various single phase converters.
5. To evaluate the performance of choppers and inverters.

**Module – 1** **08 hours**

**Introduction**: Block diagram of Power Electronics, Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects.
**Power Diodes**: Characteristics, Reverse Recovery Characteristics, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load , Single-Phase Full-Wave Rectifier with RL Load

**Module - 2** **08 hours**

**Power Transistors**: Switching characteristics of BJT, Switching characteristics of Power MOSFET and Power IGBT. Isolation of Gate and Base Drives.

**Module – 3** **08 hours**

**Thyristors**: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn On, Thyristor Turn-Off, Thyristor Types, Firing circuits, Series Operation of Thyristors, Parallel Operation of Thyristors, *di/dt* Protection, *dv/dt* Protection, Unijunction Transistor.

**Module – 4** **08 hours**

**Controlled Rectifiers**: Introduction, Single phase half wave circuit with R Load, Single-Phase Full Converters with RL Load, Single-Phase Dual Converters.
**AC Voltage Controllers**: Introduction, Principle of phase control & Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads.

**Module – 5** **08 hours**

**DC-DC Converters:** Introduction, principle of step down and step up chopper with RLE load, performance parameters, DC-DC converter classification.
**DC-AC Converters**: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters.

## PRACTICAL COMPONENT

| SN | Experiments |
|---|---|
| 1 | Static Characteristics of SCR. |
| 2 | Static Characteristics of MOSFET and IGBT. |
| 3 | SCR turn on circuit using synchronized UJT relaxation oscillator. |
| 4 | SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator. |
| 5 | Single phase controlled full wave rectifier with R load, R –L load |
| 6 | AC voltage controller using TRIAC and DIAC combination connected to R and RL loads. |
| 7 | Speed control of DC motor using single semi converter. |
| 8 | Speed control of universal motor using ac voltage regulator. |
| 9 | Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper. |
| 10 | Single phase MOSFET/IGBT based PWM inverter. |
| **Open ended Experiments** | |
| 1 | Static Characteristics of TRIAC. |
| 2 | Speed control of stepper motor. |

**Course Outcomes:**

1. **Describe** the construction, characteristics and applications of power electronics devices.
2. **Compare** the performance of various power semiconductor devices.
3. **Analyze** various turn on, turn off and protection methods of thyristors.
4. **Design** of various single phase converters.
5. **Evaluate** the performance of choppers and inverters.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Power Electronics: Circuits Devices and Applications | Mohammad H Rashid | Pearson | 4th Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Power Electronics | P.S. Bimbhra | Khanna Publishers | 5th Edition, 2012 |
| 2 | Power Electronics: Converters, Applications and Design | Ned Mohan | Wiley | 3rd Edition, 2014 |

**Semester: IV**

**Course Name: ELECTRICAL MACHINES – II (ELECTRIC MOTORS)**

| | | | |
|---|---|---|---|
| Course Code | **22EE43** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**

- Fundamentals of AC and DC circuits.
- Constructional details of AC and DC motors.
- Construction of 3-phase induction motor

**Module – 1** **08 hours**

**DC Motors:** Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt and series motors. Applications of motors. DC motor starters – 3 point and 4 point.

**Losses and Efficiency-** Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency

**Module - 2** **08 hours**

**Testing of DC Motors:** Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests.

**Three Phase Induction Motors:** Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance of slip.

**Module – 3** **08 hours**

**Performance of Three-Phase Induction Motor:** Phasor diagram of induction motor on no-load and on load, power flow diagram, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator.

**Module – 4** **08 hours**

**Starting and Speed Control of Three-Phase Induction Motors:** Need for starter. Direct on line, Star-Delta, and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods

**Single-Phase Induction Motor:** Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications.

**Module – 5** **08 hours**

**Synchronous Motor:** Principle of operation, Methods of starting synchronous motors, phasor diagrams, torque and torque angle, effect of change in load, effect of change in excitation, V and inverted V curves. Applications of Synchronous motor, hunting and damping.
**Other Motors:** Construction and operation of Universal motor, BLDC Motor, Permanent Magnet Synchronous Motor (PMSM), Written Pole Motor and stepper motors.

**Course Outcomes:**

1. **Determine** the losses and efficiency of DC machines by direct and indirect tests.
2. **Analyze** the performance characteristics of 3-Φ induction motors.
3. **Discuss** the speed control methods of DC and AC motors.
4. **Compare** construction, operation, characteristics, and applications of 1-Φ induction motors and special motors.
5. **Analyze** the performance characteristics of synchronous motor.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Electric Machines | D. P. Kothari, et al | McGraw Hill | 4th edition 2011 |
| 2 | Electric Machines | Ashfaq Hussain | Dhanpat Rai& Co | 2nd edition, 2013 |
| 3 | Theory of Alternating Current Machines | Alexander Langsdorf | McGraw Hill | 2nd Edition, 2001 |
| **Reference Books** | | | | |
| 1 | Electrical Technology | J B Gupta | Pustak Kosh | 2nd Edition |
| 2 | Theory of Alternating Current Machines | Alexander Langsdorf | McGraw Hill | 2nd Edition, 2001 |
| 3 | Principals of Electrical Machines | V.K Mehta, Rohit Mehta | S Chand | 2nd edition, 2009 |
| 4 | Electrical Machines | S.K. Sahadev | Cambridge University Press | ISBN:978-7-108-43106-4. |

**Semester: IV**
**Course Name: MICROCONTROLLER**

| | | | |
|---|---|---|---|
| IPCC Course Code | **22EE44** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **04** | Exam Hours | **03** |

**Pre-requisites:** Students should have basic knowledge of
- Basic ALU Operations and design of adders, subtractors, multiplexers etc.
- Basic CPU architecture and function of a processor
- Basic design and function of microprocessors, memory elements, instructions,
- Programming concepts of C language, data types, function of pointer.

**Course objectives:**
1. To explain the internal organization and working of Computers, microcontrollers and embedded processors.
2. To compare the various members of the 8051 family.
3. To explain the registers SFR's, different addressing modes, Assembly language instructions, data types and assembly programs.
4. To develop 8051C programs for time delay, I/O operations, I/O bit manipulation.
5. To write assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
6. To perform interfacing of LCD, sensor, relay, stepper motor and DC motor for controlling the speed.
7. To explain generation of different waveforms using DAC interface.
8. To explain Interfacing External ROM and RAM with 8051 microcontroller.

**MODULE – 1** **08 hours**

**8051 Microcontroller Basics:** Inside the computer, Microcontrollers and Embedded Processors, Pin details of 8051, Block Diagram of 8051- PC, SP PSW, Internal Memory Organization of 8051-RAM and ROM, SFR's.

**MODULE - 2** **08 hours**

**8051 Addressing modes, Instruction Set and 8051 Assembly Programming:** Assembling and running an 8051 program, 8051 Addressing Modes, Data types and Assembler directives. 8051 instruction set and operations. Introduction to 8051 assembly programming: Data transfer programming, Arithmetic programs, Code conversion programs, Call and subroutine operation and programs.

**MODULE – 3** **08 hours**

**8051 Programming in C:** Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, accessing code ROM space in 8051C, Data serialization using 8051C.
**8051 Timer Programming in Assembly and C:** Timer registers and modes, Programming 8051 timers 0 and 1 in assembly and in 8051C.

**MODULE – 4** **08 hours**

**8051 Serial Port Programming in Assembly and C:** Basics of serial communication, registers and modes, 8051 connections to RS232, 8051 serial port programming in assembly and in 8051C.
**8051 Interrupt Programming in Assembly and C:** 8051 interrupts and interrupt vector table, interrupt registers, Programming timer interrupts, external hardware interrupts, serial communication interrupt in assembly and 8051C.

**MODULE – 5** **08 hours**

**Output device interfacing:** LCD interfacing with 8051. (8051C Programming only)
**ADC, DAC and Sensor Interfacing:** ADC 0808 interfacing to 8051 and programming, MC 1408 DAC/DAC0808 DAC interfacing and programming, Sensor interfacing: LM35 interfacing and programming. (8051C Programming only)
**Motor Control:** Relay interfacing and programming. Stepper motor interfacing: Wave drive 4-step sequence. DC motor interfacing and PWM: DC motor direction control using H-bridge and PWM. (8051C Programming only)
**8051 Interfacing with External memory**: Memory address decoding, 8031/51 interfacing with external ROM, 8051 data memory space.

**PRACTICAL COMPONENT**

| SN | Experiments |
|---|---|
| 1 | Data Transfer Programs |
| 2 | Arithmetic Programs |
| 3 | Code Conversion Programs |
| 4 | Counters Programs |
| 5 | Stepper motor interface |
| 6 | DAC interfacing, |
| 7 | LCD panel interfacing |
| 8 | Elevator interfacing |
| 9 | DC motor interfacing |

**Course Outcomes:**

CO1: **Illustrate** the 8051 architecture, registers, internal memory organization, addressing modes.
CO2: **Demonstrate** the programming proficiency using various addressing modes and instructions.
CO3: **Develop** 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
CO4: **Develop** 8051 assembly and embedded C programs for serial data communication and interrupt programming.
CO5: **Demonstrate** the interfacing of microcontroller with various peripheral devices.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The 8051 Microcontroller and Embedded Systems Using Assembly and C | Muhammad Ali Mazadi | Pearson/PHI | 2nd Edition, 2008. |
| **Reference Books** | | | | |
| 1 | The 8051 Microcontroller, | Kenneth Ayala | Cengage | 3rd Edition, 2005. |
| 2 | Microcontrollers: Architecture, Programming, Interfacing and System Design | Raj Kamal | Pearson | 1st Edition, 2012 |

**Semester: IV**

**Name of the Laboratory: ELECTRICAL MACHINE LABORATORY - II**

| | | | |
|---|---|---|---|
| Course Code | **22EEL45** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **03** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |

**List of Experiments:**

| SN | Experiments |
|---|---|
| 1 | Load test on DC shunt motor to draw speed–torque and horse power–efficiency characteristics. |
| 2 | To obtain speed control of dc shunt motor using (a) Armature resistance control (b) Field control. |
| 3 | Swinburne's Test on DC motor. |
| 4 | Regenerative test on DC shunt machines (or) Hopkinson's test of dc machine. |
| 5 | Retardation Test. |
| 6 | Load test on three phase induction motor. |
| 7 | No-load and Blocked rotor test on single phase induction motor to draw i) equivalent circuit and ii) circle diagram. |
| 8 | No-load and Blocked rotor test on three phase induction motor to draw i) equivalent circuit and ii) circle diagram. |
| 9 | Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics. |
| 10 | Conduct an experiment to draw V curves of the synchronous motor from synchronization of the alternator. |
| **Open ended Experiments** | |
| 1 | Reverse rotation of 3-phase induction motor. |
| 2 | Speed control of 3-phase induction motor by stator supply voltage control method. |

**Course outcomes:**

1. **Conduct** an experiment to control the speed of DC Shunt motor by armature and field control methods.
2. **Determine** the losses and efficiency of DC machines by conducting direct and indirect loading tests.
3. **Assess** performance characteristics of DC shunt motor, 1-Ø induction motor and 3-Ø induction motor by performing load test.
4. **Analyze** the performance characteristics of 1-Ø and 3-Ø induction motors by conducting No-load and Blocked rotor tests.
5. **Perform** experiment on synchronous motor to draw V-curves and Inverted V-curves for different loads.

**Semester: IV**

**Course Name: ELECTRICAL AND ELECTRONICS MEASUREMENTS**

| | | | |
|---|---|---|---|
| Course Code | **22ESC461** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Course Learning Objectives:**

1. To measure resistance, inductance and capacitance using different bridges and determine earth resistance.
2. To study the construction and working of various meters used for measurement.
3. To study the adjustments, calibration & errors in energy meters and methods of extending the range of instruments.

**Module – 1** **08 hours**

**Measurement of Resistance:** Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger.
**Measurement of Inductance and Capacitance:** Sources and detectors, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems.

**Module - 2** **08 hours**

**Measurement of Power, Energy, Power Factor and Frequency**: Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurement of real and reactive power in 3 phase circuits. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator.

**Module – 3** **08 hours**

**Extension of Instrument Ranges:** Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characteristics, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT. **Magnetic measurements:** Introduction, measurement of flux/ flux density, magnetising force and leakage factor.

**Module – 4** **08 hours**

**Electronic and Digital Instruments:** Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True RMS reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) – Ramp type DVM, Integrating type DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (with block diagram), extra features offered by present day meters and their significance in billing.

**Module – 5** **08 hours**

**Display Devices:** Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays.

**Recording Devices:** Introduction, Strip chart recorders, Galvanometer recorders, Null balance and X-Y recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and recorders. Digital tape recording, Ultraviolet recorders. Electro Cardio Graph (ECG).

**Course Outcomes:**

1. **Measure** the resistance, inductance and capacitance using bridges and determine earth resistance.
2. **Explain** the construction and operation of various meters used for measurement of Power, Energy, Power Factor and Frequency.
3. **Discuss** the methods of extending the range of instruments and measurement of flux density.
4. **Describe** the working of different electronic instruments.
5. **Explain** the working of different display and recording devices.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Electrical and electronic Measurements and instrumentation | A.K. Sawhney Dhanpat Rai | Dhanpat Rai and Co | 10th Edition |
| 2 | A course in Electronics and Electrical Measurements and instrumentation | J. B. Gupta | Katson Books | 2013 Edition |
| 3 | Theory of Alternating Current Machines | Alexander Langsdorf | McGraw Hill | 2nd Edition, 2001 |
| **Reference Books** | | | | |
| 1 | Electrical and electronic Measurements And Instrumentation | R.K. Rajput | S Chand | 5th Edition, 2012 |
| 2 | Electrical Measuring Instruments and Measurements | S.C. Bhargava | BS Publications | 2013 |
| 3 | Modern Electronic Instrumentation and Measuring Techniques | Cooper D and A.D. Heifrick | Pearson | First Edition, 2015 |
| 4 | Electronic Instrumentation and Measurements | David A Bell | Oxford University | 3rd Edition, 2013 |
| 5 | Electronic Instrumentation | H.S.Kalsi | Mc Graw Hill | 3rd Edition,2010 |

**Semester: IV**

**PROFESSIONAL SKILLS FOR THE WORK PLACE**

| | | | |
|---|---|---|---|
| Course Code | **22PSW47** | CIE Marks | **50** |
| Teaching Hours / Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **30** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **01** |

**Pre-requisites:**
1. Basic Conversational English
2. Fundamentals of Mathematics
3. Basic Knowledge of Reasoning

**Module – 1** **06 Hours**

**Communication Skills**
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

**Module – 2** **06 Hours**

**Presentation Skills**
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience, Interaction Methods, Signing off.

**Module – 3** **06 Hours**

**Verbal & Numerical Ability**
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors, Number System, Factors and Multiples.

**Module – 4** **06 Hours**

**English Language**
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indian languages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors.

**Module – 5** **06 Hours**

**Verbal Ability and Verbal Reasoning**
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars

**Course Outcomes:**
1. Demonstrate communicative ability in a professional environment
2. Articulate one's ideas and demonstrate them to an audience
3. Transform one's English Vocabulary and Language Structure
4. Interpret international phonetic symbols, stress patterns, and enhance English speech
5. Identify patterns, determine the problem-solving process & validate solutions

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author / s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Reasoning N' Reasoning - Verbal & Non-verbal Reasoning | Dr. Ravi Chopra | Galgotia | 1994 |
| 2 | Magical Book on Quicker Math | M. Tyra | BSC | I Edition, 2018 |
| 3 | Communicate With Confidence | Diana Booher | Mc-Graw-Hill | Nov 2011 |

| **Reference Books** | | | | |
|---|---|---|---|---|
| 1 | Cambridge Advanced Learner's Dictionary | Cambridge University Press | CBS | IV Edition, 2013 |
| 2 | A Modern Approach to Verbal and Non-verbal Reasoning | R S Agarwal | S Chand | II Edition, 2018 |
| 3 | Word Power Made Easy | Norman Lewis | Goyal Publishers | IV Edition, 2014 |
| 4 | Speak With Confidence | Diana Booher | Mc-Graw-Hill | I Edition, 2002 |

**Semester: IV**
**Course Name: Universal Human Values**

| | | | |
|---|---|---|---|
| Course Code | **22UH48** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Credits | **01** | Exam Hours | **02** |
| Total Hours of Pedagogy | **15** | Total Marks | **100** |

**Module – 1** **03 Hours**

**Introduction to Value Education**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education). Understanding Value Education, Self-exploration as the Process for Value Education, Continuous.
**Happiness and Prosperity** – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

**Module - 2** **03 Hours**

**Harmony in the Human Being**
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

**Module – 3** **03 Hours**

**Harmony in the Family and Society**
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

**Module – 4** **03 Hours**

**Harmony in the Nature/Existence**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

**Module – 5** **03 Hours**

**Implications of the Holistic Understanding – a Look at Professional Ethics**
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

**Course Outcomes:**

1. Holistic vision of life.
2. Socially responsible behavior.
3. Environmentally responsible work.
4. Ethical human conduct.
5. Having Competence and Capabilities for Maintaining Health and Hygiene.
6. Appreciation and aspiration for excellence (merit) and gratitude for all.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A Foundation Course in Human Values and Professional Ethics | R R Gaur, R Asthana, G P Bagaria | Excel Books, New Delhi | 2nd Revised Edition,2019 |
| 2 | Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics | R R Gaur, R Asthana, G | | |
| **Reference Books** | | | | |
| 1 | JeevanVidya:, Jeevan | E K Parichaya, A Nagaraj | Vidya Prakashan, Amarkantak | 1999 |
| 2 | Human Values, | A.N. Tripathi | New Age Intl. Publishers, New Delhi | 2004 |

**Teaching-Learning Process:**

| |
|---|
| Various instructional methods and pedagogical initiatives used for teaching learning process of various courses are: |
| Power point presentations, Videos, Moocs, Demo models, Flipped class rooms, Problem based learning, Project based learning, Collaborative learning, Group discussion. |

**TEACHING-LEARNING PROCESS**

The Course faculty and students are recommended to follow the appropriate strategies to facilitate teaching and learning process. The following are some of the suggested teaching-learning methods but not limited to:

- Black board presentation
- Power Point Presentation
- Demonstration through YouTube videos
- Demonstration through ICT Tools / Simulation tools / Virtual Labs Industrial Visits
- Self-Study, Case Study
- Flipped Class Room, Google Class Room

**Assessment Details**
**Integrated professional Core Courses (IPCC):**

**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| **X** | **Total Marks for theory component A+B** | | | **30** |

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | 08 |
| 2 | Lab Journal Writing & Submission (B) | 10% | 02 |
| 3 | Lab Test (C) | 30% | 06 |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | 04 |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**2. Professional Core / Basic Science Courses (PCC / BSC) Theory: Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (**A**) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (**B**) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B) = 30 + 20 = 50**

**Semester End Examination (SEE)**

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks. Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module. Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**SEE** will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**3. Professional Core Course (PCC) Lab:**
**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**
1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. **Marks distribution**: **Procedure** (15%) + **Execution** (70%) + Viva Voce (15%)

**4. Ability Enhancement Course (AEC)**:
**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | 20 |
| (ii) | Lab Journal Writing & Submission (B) | 10% | 05 |
| (iii) | Lab Test (C) | 30% | 15 |
| (iv) | Open-Ended Experiments (D) | 20% | 10 |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**
1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. **Marks distribution**: **Procedure** (15%) + **Execution** (70%) + Viva Voce (15)

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**Semester: IV**
**Course Name: ADDITIONAL MATHEMATICS-II**
**(For Lateral Entry Students)**

| | | | |
|---|---|---|---|
| Course Code | **22MATDIP41** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **-** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **0** | Exam Hours | **-** |

**Pre-requisites:**
1. Differentiation
2. Integration
3. Trigonometric formulae
4. Differential equations

**Module – 1** **08 Hours**

**Higher Order ODE's**
Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular integral restricted to $\phi(x) = e^{ax}, Sinax, Cosax$ for $f(D)y = \phi(x)$
**Self-Study:** Finding particular Integral for $\phi(x) = x^m$

**Module – 2** **08 Hours**

**Partial Differential Equations (PDE's):**
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDE involving derivative with respect to one independent variable only.
**Self-Study:** Method of separation of variables

**Module – 3** **08 Hours**

**Laplace Transform:**
Definition, Laplace transforms of elementary functions. Laplace transform of $e^{at}f(t), t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.
Inverse Laplace Transform: Definition, Inverse Laplace Transform of standard functions. Inverse transform by Partial Fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differential equations.
**Self-Study:** Convolution Theorem.

**Module – 4** **08 Hours**

**Numerical Methods:**
Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method.
Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula, Lagrange's Interpolation formula without proof problems.
**Numerical Integration:** Simpson's 1/3rd and 3/8th rule (without proof) - problems.
**Self-Study:** Weddle's Rule

**Module – 5** **08 Hours**

**Probability:**
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem. Problems.
**Self-Study:** Applications of Bayes' theorem

**Course outcomes:**
1. Upon completion of this course, student will be able to,
2. Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
3. Construct a variety of partial differential equations and solution by various methods.
4. Use Laplace Transform and inverse Laplace Transform in solving differential /integral equation arising in network analysis, control systems and other fields of engineering
5. Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.
6. Use the concepts of probability in different probability distribution.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Higher Engineering Mathematics | B.S.Grewal | Khanna Publishers | 43rd Ed.2015 |
| 2 | Advanced Engineering Mathematics | E. Kreyszig | Jhon willy & Sons | 10th Ed. (Reprint) 2016 |
| 3 | Additional Mathematics-2 | Dr. Pandurangappa | Sanguine Technical Publishers | 4Th Ed., 2019. |
| **Reference Books** | | | | |
| 1 | Higher Engineering Mathematics | B.V.Ramana | Tata McGraw-Hill | 11th Edition.2010 |

**SUGGESTED TEACHING LEARNING PROCESS**

**The faculty members are suggested to use appropriately the following Teaching Learning methods:**
1. Active Learning
2. Chalk and Board for Numerical
3. Demonstration using simulator
4. Laboratory Demonstrations
5. Power Point Presentations
6. Problem based learning
7. Video Lecturers

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# Scheme of Teaching and Evaluation for

# B.E – V & VI Semester

# Electrical & Electronics Engg.

## (2021 Scheme)

**Scheme of Teaching and Evaluation for B.E Program**

# Electrical & Electronics Engineering

**With effect from the Academic Year 2021-22**

## V – Semester

| SN | Couse category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | PCC | 21EE51 | Control Systems | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21EE52 | Generation Transmission & Distribution | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21EE53 | Microcontroller | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21EE54X | Professional Elective – 1 | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21EE55X | Open Elective - 1 | Other departments offering the course | Other departments offering the course | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21EEL56 | Control System Laboratory | EEE | EEE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21EEL57 | Microcontroller Laboratory | EEE | EEE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | AEC | 21ADA580 | Advanced Aptitude | Humanities | Humanities | 0 | 2 | 0 | 1 | 1 | 50 | 50 | 100 |
| 09 | AEC | 21EE581 | Department Specific AEC T & D using Scilab | Concerned Department | Concerned Board | 0 | 0 | 2 | 1 | 1 | 50 | 50 | 100 |
| 10 | HSMC | 21EE59 | Environmental Studies | Humanities | Humanities | 0 | 2 | 0 | 1 | 1 | 50 | 50 | 100 |
| | | | | | **Total** | | | | **20** | | **500** | **500** | **1000** |

### Professional Elective – 1

| | | |
|---|---|---|
| 01 | 21EE541 | Electrical Machine Design |
| 02 | 21EE542 | Electro Magnetic Field Theory |
| 03 | 21EE543 | Electrical Engineering Materials |
| 04 | 21EE544 | Sensors & Transducers |

**Professional Elective Courses (PE):** A professional elective (PE) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

### Open Elective -1

| | | |
|---|---|---|
| 01 | 21EE551 | Electric Vehicle Technology |
| 02 | 21EE552 | Renewable Energy Resource |
| 03 | 21EE553 | Sensors and Transducers |
| 04 | 21EE554 | Solar & wind Energy |

**Open Elective Courses:** Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.

# VI – Semester

| SN | Couse category | Course Code | Course | BOS / Teaching Department | BOE / Paper Setting Board | Teaching Hours per Week | | | Credits | Duration of Exam | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L | T | P | | | CIE | SEE | Total |
| 01 | *HSMC* | 21EE61 | Management & Entrepreneurship | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 02 | PCC | 21EE62 | Power System Analysis-1 | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 03 | PCC | 21EE63 | Signals & Digital Signal Processing | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 04 | PE | 21EE64X | Professional Elective-2 | EEE | EEE | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 05 | OE | 21EE65X | Open Elective-2 | Other Departments Offering the Course | | 2 | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| 06 | PCC | 21EEL66 | Digital Signal Processing Laboratory | EEE | EEE | 0 | 0 | 3 | 1 | 3 | 50 | 50 | 100 |
| 07 | PCC | 21EEL67 | Computer Aided Electrical Drawing | EEE | EEE | 0 | 0 | 2 | 1 | 3 | 50 | 50 | 100 |
| 08 | PW | 21MN68 | Mini Project | EEE | EEE | Two contact hours /week for interaction between the faculty and students | | | 2 | 3 | 50 | 50 | 100 |
| 09 | AEC | 21EE691 | Modelling & Simulation of Electric Vehicle system Using MATLAB. | EEE | EEE | 0 | 0 | 2 | 1 | 1 | 50 | 50 | 100 |
| 10 | INT | 21INT691 | Summer Internship-II | Completed during the intervening period of IV & V semesters. | --- | | | | | | 100 | - | 100 |
| | | | | | **Total** | | | | **20** | | **550** | **450** | **1000** |

## Professional Elective –2

| | | |
|---|---|---|
| 01 | **21EE641** | **Utilization of Electrical Power** |
| 02 | 21EE642 | Renewable Energy Sources |
| 03 | 21EE643 | Electrical Vehicle Technology |
| 04 | 21EE644 | Energy Storage Systems |

## Open Elective -2

| | | |
|---|---|---|
| 01 | **21EE651** | **Energy storage technologies for EV.** |
| 02 | 21EE652 | Utilization of Electrical Power |
| 03 | 21EE653 | Industrial Servo Control Systems |
| 04 | 21EE654 | Advanced Control Systems |

## Internship – II (21INT691):

All the students admitted to engineering programmes shall have to undergo a mandatory internship-II of 04 weeks during the intervening vacation of IV and V semesters.

All the students TAKING FAST TRACK /SUPPLEMENTARY SEMESTER shall have to undergo a mandatory internship-II of 04 weeks during the intervening period of V and VI semesters. Internship-II shall include Innovation/ Entrepreneurship / Societal based Internship. A Viva-voce examination (Presentation followed by question-answer session) shall be conducted during VI semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examinations after satisfying the internship requirements The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.

# Scheme of Teaching and Evaluation for

# B.E – V Semester

# Electrical & Electronics Engg.

# (2021 Scheme)

## Semester: V
## Course Name: Control Systems

| | | | |
|---|---|---|---|
| PCC Course Code | **21EE51** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Module – 1** **08 Hours**

**Introduction to Control Systems:** Introduction, classification of control systems.
**Mathematical Models Of Physical Systems:** Modelling of mechanical system elements, electrical systems, Analogous systems, transfer function, Single input single output systems, Procedure for deriving transfer functions of servomotor.

**Module – 2** **08 Hours**

**Block Diagram:** Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function.
**Signal Flow Graphs:** Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems.

**Module – 3** **08 Hours**

**Time Domain Analysis:** Standard test signals, time response of first order systems, time response of second order systems, steady state errors and error constants.
**Routh Stability Criterion:** BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis.

**Module – 4** **08 Hours**

**Root Locus Technique:** Introduction, root locus concepts, construction of root loci, rules for the construction of root locus.
**Bode Plots:** Basic factors G(jw)/H(jw), General procedure for constructing bode plots, computation of gain margin and phase margin.

**Module – 5** **08 Hours**

**Nyquist Plot:** Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion.
**Control Systems:** Introduction, PD Controller, PI Controller
PID Controller, Phase-Lead Controller, Phase - Lag Controller, Lead-Lag Controller (Excluding Design).

**Course Outcomes:**

CO1: Develop the differential equations for given mechanical and electrical systems.
CO2: Apply block diagram manipulation and signal flow graph methods to obtain transfer function of systems.
CO3: Investigate the performance of a given system in time and frequency domain.
CO4: Evaluate the stability of LTI systems using RH criterion, root locus, Bode Plot and Nyquist plot.
CO5: Compare the different compensator configurations and controller configurations.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Control Systems | Anand Kumar | PHI | 2nd Edition, 2014 |
| 2 | Automatic Control Systems | Farid Golnaraghi, Benjamin C. Kuo | Wiley | 9th Edition, 2010 |
| 3 | Control System Engineering | Norman S. Nise | Wiley | 4th Edition, 2004. |
| 4 | Modern Control Systems | Richard C Dorf et al | Pearson | 11th Edition, 2008 |
| **Reference Books** | | | | |
| 1 | Control Systems, Principles and Design | M. Gopal | McGraw Hill | 4th Edition, 2012 |
| 2 | Control Systems Engineering | S. Salivahanan et al | Pearson | 1st Edition, 2015 |

## Semester: V
## Course Name: Generation, Transmission & Distribution (GTD)

| | | | |
|---|---|---|---|
| PCC Course Code | **21EE52** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**
- Students should have basic knowledge of
- Different types of generating stations
- Single phase and three phase systems
- Ohm's and Kirchhoff's laws
- Voltage, current and power calculations in R, R-L, R-L-C series circuits.
- Operations of transformer, Motor and generator.

**Course objectives:**
1. To understand the structure of electric power system: Generation, Transmission & Distribution of power.
2. To understand the importance of higher voltage transmission and comparison of HVAC and HVDC transmission systems.
3. To design insulators for a given voltage level.
4. To calculate the parameters of the transmission line for different configurations and assess the performance of the line.
5. To study underground cables for power transmission and evaluate different types of distribution systems.

**Module – 1** **08 Hours**

**Generation of Electrical Energy:** Importance of electrical energy, energy sources and their availability, generation of electrical energy, Principle types of power plants- conventional plants. Site selection, schematic arrangement and working of Hydro, Thermal, and Nuclear generating stations including advantages and disadvantages. Comparison of the various power plants based on initial cost, running cost, efficiency, maintenance, losses, space required etc.
**Introduction to Power System:** Structure of electric power system, Single line diagram of power system with voltage levels, Advantages of higher voltage transmission, Comparison of HVAC and HVDC transmission system.

**Module – 2** **08 Hours**

**Mechanical Design of Overhead Transmission Lines:** Main components of overhead lines: conductors, supports, insulators. Properties and types of conductors: AAC, AAAC, ACSR, Bundled conductors. Properties and types of supporting structures. Importance of Sag in overhead lines, Sag calculation – supports at same and different levels, effect of wind and ice.
**Overhead Line Insulators:** A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency.

**Module – 3** **08 Hours**

**Line Parameters:** Introduction to line parameters- resistance, inductance and capacitance. Skin effect.
**Calculation of inductance:** single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, Concept of Self-GMD and Mutual-GMD, Inductance formulas in terms of GMD.
**Calculation of capacitance:** single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines.

**Module – 4** **08 Hours**

**Performance of Transmission Lines:** Classification of overhead lines – short, medium and long. Important terms- voltage regulation, transmission efficiency. Performance analysis of short transmission lines, Medium transmission line considering Nominal T and Nominal π lines, and long transmission lines by Rigorous method. Generalized circuit constants (ABCD), Determination of ABCD constants for transmission lines.
**Corona:** Theory of corona formation, factors affecting corona, Important terms- disruptive and visual critical voltages, corona loss, Advantages and disadvantages of corona, Methods of reducing corona.

**Module – 5** **08 Hours**

**Distribution Systems:** Feeders, distributors and service mains, classification according to scheme of connection – Radial, Ring main and interconnected system.
**DC distribution:** Types of DC distributors, DC distributor calculations, Distributor fed at one end, fed at both ends, fed at the center, ring distributor.
**Underground Cables:** Constructional features, Types of cables, insulation resistance, capacitance and Dielectric Stress in a Single-Core Cable, most economical conductor size in a cable, grading of cables – capacitance and inter-sheath.

**Course Outcomes:**

At the end of the course the student will be able to:
CO1: Describe the working of various types of conventional power plants.
CO2: Compute the parameters related to mechanical design of overhead transmission line.
CO3: Analyze and compute the parameters of the transmission line for different configurations.
CO4: Analyze the performance of transmission lines and corona phenomenon.
CO5: Evaluate the different types of distribution systems and underground cables.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A course in electrical Power | Soni Gupta and Bhatnaghar | Dhanpat Rai | - |
| 2 | Principles of Power system | V. K. Mehta, Rohit Mehta | S. Chand | 1st Edition, 2013 |
| **Reference Books** | | | | |
| 1 | Electrical power generation, transmission and distribution | S. N. Singh | PHI | 2nd Edition, 2009 |
| 2 | Electrical Power Systems | C. L. Wadhwa | New age | 5th Edition |
| 3 | Electrical Power Systems | Ashfaq Hussain | CBS Publication | 5th Edition |
| 4 | A course in power systems | J. B. Gupta | Kataria & sons | 2013 |

## Semester: V
## Course Name: Microcontroller

| | | | |
|---|---|---|---|
| PCC Course Code | **21EE53** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**

Students should have basic knowledge of
- Basic ALU Operations and design of adders, subtractors, multiplexers etc.
- Basic CPU architecture and function of a processor
- Basic design and function of microprocessors, memory elements, instructions.
- Programming concepts of C language, data types, function of pointer.

**Course objectives:**

1. To explain the internal organization and working of Computers, microcontrollers and embedded processors.
2. To compare the various members of the 8051 family.
3. To explain the registers SFR's, different addressing modes, Assembly language instructions, data types and assembly programs.
4. To develop 8051C programs for time delay, I/O operations, I/O bit manipulation.
5. To write assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
6. To perform interfacing of LCD, sensor, relay, stepper motor and DC motor for controlling the speed.
7. To explain generation of different waveforms using DAC interface.
8. To explain Interfacing External ROM and RAM with 8051 microcontroller.

**Module – 1** **08 hours**

**8051 Microcontroller Basics:** Inside the computer, Microcontrollers and Embedded Processors, Pins details of 8051, Block Diagram of 8051- PC, SP PSW, Internal Memory Organization of 8051-RAM and ROM, SFR's.

**Module - 2** **08 hours**

**8051 Addressing modes, Instruction Set and 8051 Assembly Programming:** Assembling and running an 8051 program, 8051 Addressing Modes, Data types and Assembler directives. 8051 instruction set and operations. Introduction to 8051 assembly programming: Data transfer programming, Arithmetic programs, Code conversion programs, Call and subroutine operation and programs.

**Module – 3** **08 hours**

**8051 Programming in C:** Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051C, accessing code ROM space in 8051C, Data serialization using 8051C.
**8051 Timer Programming in Assembly and C:** Timer registers and modes, Programming 8051 timers 0 and 1 in assembly and in 8051C.

**Module – 4** **08 hours**

**8051 Serial Port Programming in Assembly and C:** Basics of serial communication, registers and modes, 8051 connections to RS232, 8051 serial port programming in assembly and in 8051C.
**8051 Interrupt Programming in Assembly and C:** 8051 interrupts and interrupt vector table, interrupt registers, Programming timer interrupts, external hardware interrupts, serial communication interrupt in assembly and 8051C.

**Module – 5** **08 hours**

**Output device interfacing:** LCD interfacing with 8051(8051C Programming only)
**ADC, DAC and Sensor Interfacing:** ADC 0808 interfacing to 8051 and programming, MC 1408 DAC/DAC0808 DAC interfacing and programming, Sensor interfacing: LM35 interfacing and programming. (8051C Programming only)
**Motor Control:** Relay interfacing and programming. Stepper motor interfacing: Wave drive 4-step sequence. DC motor interfacing and PWM: DC motor direction control using H-bridge and PWM. (8051C Programming only)
**8051 Interfacing with External memory:** Memory address decoding, 8031/51 interfacing with external ROM, 8051 data memory space.

**Course Outcomes:**

CO1: Illustrate the 8051 architecture, registers, internal memory organization, addressing modes.
CO2: Demonstrate the programming proficiency using various addressing modes and instructions.
CO3: Develop 8051 programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
CO4: Develop 8051 assembly and embedded C programs for serial data communication and interrupt programming.
CO5: Demonstrate the interfacing of microcontroller with various peripheral devices.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | The 8051 Microcontroller and Embedded Systems Using Assembly and C | Muhammad Ali Mazadi | Pearson/PHI | 2nd Edition, 2008. |
| **Reference Books** | | | | |
| 1 | The 8051 Microcontroller, | Kenneth Ayala | Cengage | 3rd Edition, 2005. |
| 2 | Microcontrollers: Architecture, Programming, Interfacing and System Design | Raj Kamal | Pearson | 1st Edition, 2012 |

## Semester: V
## Course Name: Electrical Machine Design (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | **21EE541** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Module – 1** **08 Hours**

**Fundamental Aspects of Electrical Machine Design:** Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.
**Electrical Engineering Materials:** Desirability of Conducting Materials, Comparison of Aluminum and Copper Wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating Materials based on Thermal Consideration.

**Module – 2** **08 Hours**

**Design of DC Machines:** Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit Dimensions of Yoke, Main Pole and Air Gap, Design of Shunt and Series Field Windings

**Module – 3** **08 Hours**

**Design of Transformers:** Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and Design of Tank and Cooling Tubes

**Module – 4** **08 Hours**

**Design of Three Phase Induction Motors:** Output Equation, Choice of Specific Loadings, Main Dimensions of Stator, Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor, Design End Ring, Design of Slip Ring Rotor, Estimation of No Load Current and Leakage Reactance

**Module – 5** **08 Hours**

**Design of Three Phase Synchronous Machines:** Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator, Design of stator slots and windings, Design of Salient and non-salient Pole Rotors, Magnetic Circuit and Field Winding.

**Course Outcome**:
At the end of the course the student will be able to:
- **CO1:** **Identify** and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
- **CO2:** **Derive** the output equation of the DC machine; discuss the selection of specific loadings, design of the field system and armature circuits of a DC machine.
- **CO3:** **Obtain** the output equations of the transformer, discuss the selection of specific loadings, and estimate the number of cooling tubes, no-load current and leakage reactance of core type transformer.
- **CO4:** **Develop** the output equation of the induction motor; discuss selection of specific loadings, design stator and rotor circuits of an induction motor.
- **CO5:** **Formulate** the output equation of the alternator, design the field windings, salient pole and non-salient pole alternators for given specifications.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A course in Electrical Machine Design | A. K. Sawhney | DhanpatRai | 6th Edition, 2013. |
| 2 | Design of Electrical machines | V.N. Mittle, | STD publishers | 4th Edition |
| **Reference Books** | | | | |
| 1 | Performance and Design of Alternating Current Machines | M.G. Say | CBS Publisher | 3rd Edition, 2002. |
| 2 | Design Data Handbook | A. Sanmugasundaram Et al | New Age International | 1st Edition, 2011 |

## Semester: V
## Course Name: Electro-Magnetic Field Theory (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | 21EE542 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Module – 1** **08 Hours**

**Coulomb's Law and Electric Field Intensity:** Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge.
**Electric Flux Density, Gauss' Law and Divergence:** Electric flux density, Gauss' law, Divergence, Maxwell's First equation (Electrostatics), vector operator and divergence theorem.

**Module – 2** **08 Hours**

**Energy and Potential:** Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient, Energy density in an electrostatic field.
**Conductors, Dielectrics and Capacitance:** Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, Capacitance and examples.

**Module – 3** **08 Hours**

**Poisson's and Laplace's Equations:** Derivations of Poisson's and Laplace's Equations, Uniqueness Theorem, Examples of the solutions of Laplace's and Poisson's equations.

**Module – 4** **08 Hours**

**The Steady Magnetic Field**: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.
**Magnetic Forces:** Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

**Module – 5** **08 Hours**

**Time Varying Fields And Maxwell's Equations:** Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Evaluate the electric fields produced by different charge configurations using different coordinate systems, Coulomb's Law and Gauss Law for the

CO2: Calculate the energy and potential due to a system of charges & Explain the behavior of electric field across a boundary conditions.

CO3: Analyze the Poisson's, Laplace equations and behavior of steady magnetic fields.

CO4: Discuss the behavior of magnetic fields and magnetic materials.

CO5: Asses time varying fields and propagation of waves in different media.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Engineering Electromagnetic | William H Hayt et al | McGraw Hill | 8th Edition, 2014 |
| 2 | Principles of Electromagnetics | Matthew N. O. Sadiku | Oxford | 6th Edition, 2015. |

## Semester: V
## Course Name: Electrical Engineering Materials (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | **21EE543** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**
Students should have basic knowledge of
- Passive electrical components like resistor, capacitor
- Nonlinear elements such as diodes and insulators
- Behavior of magnetic materials

**Course objectives:**
1. To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications.
2. To impart the knowledge of superconducting materials and their applications.
3. To impart the knowledge of the Electric vehicle sources and storage devices

**Module – 1** **08 hours**

**Introduction to Electrical and Electronic Materials:** Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap
**Conductors:** Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect
**Conductive Materials and Applications:** Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors.

**Module – 2** **08 hours**

**Dielectrics:** Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant.
**Insulating Materials:** Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.

**Module – 3** **08 hours**

**Magnetic Materials:** Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetic and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial, and maximum permeability. Hysteresis loop and loss, Eddy current loss. Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials. Magnetostriction.

**Module – 4** **08 hours**

**Superconductive Materials:** Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets, MRI for medical diagnostics.

**Module – 5** **08 hours**

**Materials for Energy Storage Devices in Electric Vehicles:** Energy storage requirements, Battery parameters, Types of Batteries, Classification of batteries based on specific energy and power, Lead acid batteries, Nickel based batteries, Li-ion battery, advantages and application of Li-ion battery.

**Course Outcomes:**

CO1: Calculate the resistance, thermal conductivity of the materials for the change in temperature.
CO2: Select an insulating material for a specific application based on the working temperature and nature of the working environment.
CO3: Select the magnetic material which best fits for the desired application based on B-H curve, soft & hard magnetic properties.
CO4: Choose the super conducting material for given application based on working temperature and influence of external and internal magnetic field.
CO5: Identify the battery suitable for EV vehicles based on the type of vehicle and characteristics.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Advanced Electrical and Electronics Materials; Processes and Applications | K.M. Gupta, Nishu Gupta | Wiley | 1$^{st}$ Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Electronic Engineering Materials | R.K. Shukla, Archana Singh | McGraw Hill | 2012 |
| 2 | Electrical Properties of Materials | L Solymar et al | Oxford | 9$^{th}$ Edition, 2014. |
| 3 | Modern Electric, Hybrid Electric & Fuel Cell Vehicles | Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi | CRC Press | 3$^{rd}$ Edition, 2018 |

## Semester: V
## Course Name: Sensors & Transducers (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | **21EE544** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**
Students should have basic knowledge of
- SI Units.
- Identification of measuring devices.
- Basic knowledge of analog and digital converters.
- Different types electrical and non-electrical quantities.

**Course objectives:**
1. To discuss need of transducers, their classification, advantages and disadvantages.
2. To discuss working of different types of transducers and sensors.
3. To discuss recent trends in sensor technology and their selection.
4. To discuss basics of signal conditioning and signal conditioning equipment.
5. To discuss configuration of Data Acquisition System and data conversion.
6. To explain measurement of various non-electrical quantities.

**Module – 1** **08 hours**

**Sensors and Transducers:** Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.

**Module - 2** **08 hours**

**Sensors and Transducers (continued):** Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchro's and Resolvers, Induction Potentiometers.

**Module – 3** **08 hours**

**Signal Condition:** Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.
**Data Acquisition Systems and Conversion:** Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion.

**Module – 4** **08 hours**

**Measurement of Non – Electrical Quantities:** Pressure Measurement. Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, and Wire Anemometers.

**Module – 5** **08 hours**

**Measurement of Non – Electrical Quantities (continued):** Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity.

**Course Outcomes**:

CO1: Discuss need of transducers, working, their classification, applications, advantages and disadvantages.
CO2: Explain the working of various transducers and sensors.
CO3: Analyze the signal conditioning and signal conditioning equipment.
CO4: Illustrate different configuration of data acquisition system and data conversion.
CO5: Explain measurement of non-electrical quantities such as temperature, flow, speed, force, shaft power, liquid level and viscosity.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Electronic Measurements and Instrumentation | R.K. Rajput | S. Chand | 3rd Edition, 2013 |
| **Reference Books** | | | | |
| 1 | A Course in Electronics and Electrical Measurements and Instruments | J.B. Gupta | Katson Books | 13th Edition, 2008 |
| 2 | A Course in Electrical and Electronic Measurements and Instrumentation | A. K. Sawheny | Dhanpat Rai | 19th Edition, 2015 |

## Semester: V
## Course Name: Electric Vehicle Technology (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | 21EE551 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Course objectives:**
The course is a beginner-level course designed to introduce students to Electric vehicles and give them a brief idea about electric vehicles, and its importance. This course gives some basic technical foundations regarding electric vehicles In-order to help them move on to advanced electric vehicle courses.

**Module – 1** **08 hours**

**Introduction to Electric Vehicles:** Components of Electric Vehicle, Comparison with Internal Combustion Engine: Technology, Benefits and Challenges, EV classification and their electrification levels.

**Module – 2** **08 hours**

**Electric and Plug-in Electric Vehicle:** Configurations of Electric Vehicles (EV), Performance of EV, Architectures of EV, Vehicle batteries and its modelling, Battery operated EV, Plug-in EV

**Module – 3** **08 hours**

**Electric Propulsion Unit:** Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive efficiency.

**Module – 4** **08 hours**

**Energy Storage Systems:** Energy storage systems used; Battery electrochemistry, battery design and construction, charging and discharging, power density, Battery interface with motive sources.

**Module – 5** **08 hours**

**Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

**Course Outcomes:**
After completion of this course Students will be able to:
CO1: Explain the components of Electric Vehicle, Comparison, benefits, Challenges and classification.
CO2: Explain the configurations of Electric Vehicles, performance, architectures, vehicle batteries and their modelling.
CO3: Analyze the use of different electric motor drives and controls in electric vehicles.
CO4: Describe Energy storage systems, battery electrochemistry, battery design, construction, and performance.
CO5: Compare energy management strategies in electric vehicle.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| 1 | Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design. | Mehrdad Ehsani et al, | CRC Press | 1st Edition, 2005 |
| 2 | "Electric Vehicle Technology Explained, " | James Larminie and John Lowry | John Wiley & Sons Ltd, | 2003 |

## Semester: V
## Course Name: Renewable Energy Sources (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | 21EE552 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

1. To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
2. To discuss about solar energy reaching the Earth's surface and solar thermal energy applications.
3. To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
4. To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
5. To discuss wind turbines, wind resources, site selection for wind turbine.
6. To discuss geothermal systems, their classification and geothermal based electric power generation
7. To discuss waste recovery management systems, advantages and disadvantages.
8. To discuss biomass composition, production, types of biomass gasifiers, properties of producer gas benefits.
9. To discuss tidal energy resources, energy availability, power generation.

**Module – 1** **08 hours**

**Introduction:** Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.
**Energy from Sun:** Sun- earth Geometric Relationship, Layer of the Sun, Earth–Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications.

**Module – 2** **08 hours**

**Solar Thermal Energy Collectors:** Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.
**Solar Cells:** Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic panels (series and parallel arrays).

**Module – 3** **08 hours**

**Hydrogen Energy:** Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.
**Wind Energy:** Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.
**Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.
**Solid waste and Agricultural Refuse:** Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics.

**Module – 4** **08 hours**

**Biomass Energy:** Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.
**Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.
**Tidal Energy:** Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.

**Module – 5** **08 hours**

**Sea Wave Energy:** Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.
**Ocean Thermal Energy:** Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC.

**Course outcome**

At the end of the course the student will be able to :

CO1: Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2: Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
CO3: Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4: Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5: Discuss production of energy from biomass, biogas and Summarize tidal energy resources, sea wave energy and ocean thermal energy.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Nonconventional Energy Resources | Shobh Nath Singh | Pearson | 1st Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Nonconventional Energy Resources | B.H. Khan | McGraw Hill | 3rd Edition |
| 2 | Renewable Energy; Power for a sustainable Future | Godfrey Boyle | Oxford | 3rd Edition, 2012. |
| 3 | Renewable Energy Sources: Their Impact on global Warming and Pollution | Tasneem Abbasi S.A. Abbasi | PHI | 1st Edition, 2011. |

## Semester: V
## Course Name: Sensors & Transducers (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | **21EE553** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**
Students should have basic knowledge of
- SI Units.
- Identification of measuring devices.
- Basic knowledge of analog and digital converters.
- Different types electrical and non-electrical quantities.

**Course objectives:**
1. To discuss need of transducers, their classification, advantages and disadvantages.
2. To discuss working of different types of transducers and sensors.
3. To discuss recent trends in sensor technology and their selection.
4. To discuss basics of signal conditioning and signal conditioning equipment.
5. To discuss configuration of Data Acquisition System and data conversion.
6. To explain measurement of various non-electrical quantities.

**Module – 1** **08 Hours**

**Sensors and Transducers:** Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.

**Module – 2** **08 Hours**

**Sensors and Transducers (continued):** Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchro's and Resolvers, Induction Potentiometers.

**Module – 3** **08 Hours**

**Signal Condition:** Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.
**Data Acquisition Systems and Conversion:** Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion.

**Module – 4** **08 Hours**

**Measurement of Non – Electrical Quantities:** Pressure Measurement. Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, and Wire Anemometers.

**Module – 5** **08 Hours**

**Measurement of Non – Electrical Quantities (continued):** Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity.

**Course Outcomes:**

CO1: Discuss need of transducers, working, their classification, applications, advantages and disadvantages.
CO2: Explain the working of various transducers and sensors.
CO3: Analyze the signal conditioning and signal conditioning equipment.
CO4: Illustrate different configuration of data acquisition system and data conversion.
CO5: Explain measurement of non-electrical quantities such as temperature, flow, speed, force, shaft power, liquid level and viscosity.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Electronic Measurements and Instrumentation | R.K. Rajput | S. Chand | 3rd Edition, 2013 |
| **Reference Books** | | | | |
| 1 | A Course in Electronics and Electrical Measurements and Instruments | J.B. Gupta | Katson Books | 13th Edition, 2008 |
| 2 | A Course in Electrical and Electronic Measurements and Instrumentation | A. K. Sawheny | Dhanpat Rai | 19th Edition, 2015 |

## Semester: V
## Course Name: Solar and Wind Energy (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | **21EE554** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P: S) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course Learning Objectives:**

1. To discuss the importance of energy in human life, relationship among economy and environment with energy use.
2. To discuss the increasing role of renewable energy, energy management, energy audit, energy efficiency, energy intensity.
3. To discuss energy consumption status in India, energy saving potential and energy conservation efforts in India.
4. To explain the concept of energy storage and the principles of energy storage devices.
5. To discuss the characteristics and distribution of solar radiation, measurement of components of solar radiation and analysis of collected solar radiation data.
6. To describe the process of harnessing solar energy in the form of heat and working of solar collectors.
7. To discuss applications of solar energy including heating and cooling. sizing and design of typical solar PV systems and their applications.
8. To discuss basic Principles of Wind Energy Conversion and to compute the power available in the wind.

**Module – 1** **08 Hours**

**Fundamentals of Energy Science and Technology:** Introduction, Energy, Economy and Social Development, Classification of Energy Sources, Importance of Non -conventional Energy Sources, Salient features of Non-conventional Energy Sources, World Energy Status, Energy Status in India.
**Energy Conservation and Efficiency:** Introduction, Important Terms and Definitions, Important Aspects of Energy Conservation, Global Efforts, Achievements and Future Planning, Energy Conservation/Efficiency Scenario in India, Energy Audit, Energy Conservation Opportunities.
**Energy Storage:** Introduction, Necessity of Energy Storage, Specifications of Energy Storage Devices. Solar
**Energy-Basic Concepts:** Introduction, The Sun as Source of Energy, The Earth, Sun, Earth Radiation Spectrum, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, Depletion of Solar Radiation.

**Module – 2** **08 Hours**

**Solar Energy-Basic Concepts (continued):** Measurement of Solar Radiation, Solar Radiation Data, Solar Time, Solar Radiation Geometry, Solar Day Length, Extraterrestrial Radiation on Horizontal Surface, Empirical Equations for Estimating Terrestrial Solar Radiation on Horizontal Surface, Solar Radiation on Inclined Plane Surface.
**Solar Thermal Systems:** Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers.

**Module – 3** **08 Hours**

**Solar Photovoltaic Systems:** Introduction, Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell Technologies, Solar Cell, Module, and Array Construction, Maximizing the Solar PV Output and Load Matching. Maximum Power Point Tracker. Balance of System Components, Solar PV Systems, Solar PV Applications.

**Module – 4** **08 Hours**

**Wind Energy:** Introduction, Basic Principles of Wind Energy Conversion, History of Wind Energy, Wind Energy Scenario – World and India. The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations.
**Wind Energy Systems:** Environment and Economics Environmental benefits and problems of wind energy, Economics of wind energy, Factors influence the cost of energy generation, machine parameters, Life cycle cost analysis.

**Module – 5** **08 Hours**

**Basic Components of a Wind Energy Conversion(WEC) System:** Classification of WEC systems, Advantages and Disadvantages of WECS, Types of Wind Machines (Wind Energy Collectors), Analysis of Aerodynamic Forces Acting on the Blade, Performance of Wind- machines, Generating Systems, Energy Storage, Applications of Wind Energy, Environmental Aspects.

**Course Outcomes:**

CO1: Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices.
CO2: Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system.
CO3: Describe the process of harnessing solar energy and its applications in heating and cooling.
CO4: Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection.
CO5: Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Non-Conventional Energy Resources | B. H. Khan | McGraw Hill | 2nd Edition 2017 |
| 2 | Non-Conventional Sources of Energy | Rai G. D. | Khanna Publishers | 4th Edition, 2009 |
| **Reference Books** | | | | |
| 1 | "Non-Conventional Energy Resources | ShobhNath Singh | Pearson | 1st Edition, 2015 |
| 2 | "Solar Energy – Principles of Thermal Collections and Storage | S.P. Sukhatme J.K.Nayak | McGraw Hill | 3rd Edition, 2008 |
| 3 | Wind Turbine Technology | Ahmad Hemami | Cengage | 1st Edition, 2012 |

## Semester: V
## Course Name: Control System Laboratory

| | | | |
|---|---|---|---|
| PCC Course Code | **21EEL56** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

**Course Learning Objectives:**
1. To determine the time and frequency domain reposes of a given second order system using software package or discrete components.
2. To design and analyze Lead, Lag and Lag – Lead compensators for given specifications.
3. To draw the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair.
4. To study the DC position & feedback control system and to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
5. To write a script files to plot root locus, bode plot, to study the stability of the system using a Sl. Software package.

| SN | List of Experiments |
|---|---|
| 1 | Experiment to draw the speed torque characteristics of AC servo motor. |
| 2 | Experiment to draw the speed torque characteristics of DC servo motor. |
| 3 | Experiment to draw characteristics of synchro transmitter and receiver pair. |
| 4 | Experiment to determine frequency response of a second order system. |
| 5 | Experiment to draw the frequency response characteristics of the lead compensator network and determination of its transfer function. |
| 6 | Experiment to draw the frequency response characteristics of the lag compensator network and determination of its transfer function. |
| 7 | To study a second order system and verify the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response. |
| 8 | (a) To simulate a typical second order system and determine step response and evaluate time response specifications.<br>(b) To evaluate the effect of adding poles and zeros on time response of second order system.<br>(c) To evaluate the effect of pole location on stability |
| 9 | (a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response<br>(b) To study the effect of open loop gain on transient response of closed loop system using root locus. |
| 10 | (a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response<br>(b) To study the effect of open loop gain on transient response of closed loop system using Bode Plot. |
| 11 | (a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response<br>(b) To study the effect of open loop gain on transient response of closed loop system using Nyquist plot. |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems
CO2: Evaluate time domain specifications of a typical second order system.
CO3: Analyze Lead and Lag compensators for given specifications.
CO4: Compare different types of controllers.
CO5: Assess the stability of given transfer function using Root locus, Bode plot and Nyquist plot.

## Semester: V
## Course Name: Microcontroller Lab

| | | | |
|---|---|---|---|
| PCC Course Code | **21EEL57** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

### List of Experiments

| SN | Experiments |
|---|---|
| 1 | Data Transfer Programs – Programs for block data movement from internal RAM to internal RAM, external RAM to internal RAM, sorting, exchanging, and finding largest element in an array. |
| 2 | Arithmetic Programs: Addition, subtraction, multiplication and division, Square and cube operations. |
| 3 | Code Conversion Programs – BCD to ASCII, ASCII to BCD, ASCII to Hexadecimal, Hexadecimal to ASCII, Decimal to Hexadecimal, Hexadecimal to and Decimal, use of Boolean and logical instructions. |
| 4 | Counters Programs using delay, Serial port Programming and on-chip timer/counters, sorting positive and negative numbers, sorting odd and even numbers, use of conditional call and return instructions. |
| 5 | Stepper motor interface with 8051 microcontroller - rotating in clock, anticlockwise direction and rotating in angle. |
| 6 | Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface with 8051 microcontroller. |
| 7 | Alphanumerical LCD panel interface with 8051 microcontroller. |
| 8 | Elevator interface with 8051 microcontroller. |
| 9 | DC motor interface with 8051 microcontroller for direction and speed control using PWM. |
| | **Open ended Experiments** |
| 1 | Interface a LED to 8051 microcontroller and turn ON and OFF using timer. |
| 2 | Interface a relay with 8051 microcontroller to control appliance connected to the relay. |

***Note**: For the experiments 1 to 4, 8051 assembly programming is used and for the experiments 5 to 9 Single chip solution for interfacing 8051 with C Programs.*

**Course Outcomes:**

CO1: Implement the programming skills for data transfer, arithmetic, Boolean and logical operations.
CO2: Develop ALP for code conversion programs.
CO3: Demonstrate ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication.
CO4: Illustrate interfacing of elevator, stepper motor and DC motor for controlling the speed.
CO5: Simulate different waveforms using DAC interface.

## Semester: V
## AEC Name: T & D Using Scilab

| | | | |
|---|---|---|---|
| Course Code | **21AEC581** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Hours of Pedagogy | **20** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

### List of Experiments

| SN | Experiments |
|---|---|
| 1. | Determination of Inductance and capacitance of single phase transmission line. |
| 2. | Determination of Inductance and capacitance of three phase transmission line. |
| 3. | Determination of efficiency and regulation of short transmission line using ABCD constants |
| 4. | Determination of efficiency and regulation of medium and long transmission line using ABCD parameters for both T and Pi-Configurations. |
| 5. | Determination of Visual and Disruptive Critical Voltages with power loss due to Corona effect in transmission lines. |
| 6. | Determination of Capacitance of three phase underground cables with and without grading. |
| 7. | Determination of string efficiency of overhead line insulators. |
| 8. | Determination of voltages in radial distribution feeders with concentrated loads. |

**Course Outcomes:**

CO1: Determine Inductance and capacitance of 1-ϕ and 3-ϕ transmission lines.

CO2: Determine efficiency and regulation of short, medium and long transmission line using ABCD parameters for both T and Pie-Configurations.

CO3: Determine capacitance of three phase underground cables with and without grading.

CO4: Determine string efficiency of overhead line insulators

CO5: Determine voltages in radial distribution feeders with concentrated loads.

# Scheme of Teaching and Evaluation for

# B.E – VI Semester

# Electrical & Electronics Engg.

# (2021 Scheme)

## Semester: VI
## Course Name: Management, Entrepreneurship and Engineering Economics

| | | | |
|---|---|---|---|
| PCC Course Code | **21EE61** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course objectives:**
1. The fundamentals of management functions of a manager. Also explain planning and decision making process
2. The fundamentals of Entrepreneurship development process
3. The working of small scale industries, various types of supporting agencies and financing available for an entrepreneur.
4. To study the economic aspects and different tariff of electrical power energy.

**Module – 1** **08 Hours**

**Management:** Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession.
**Planning:** Nature, Importance and Purpose of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.

**Module - 2** **08 Hours**

**Organizing and Staffing:** Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.
**Directing and Controlling:** Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling.

**Module – 3** **08 Hours**

**Social Responsibilities of Business:** Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance.
**Entrepreneurship:** Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs.

**Module – 4** **08 Hours**

**Modern Small Business Enterprises:** Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs.
**Institutional Support for Business Enterprises:** Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions.

**Module – 5** **08 Hours**

**Economic Aspects:** Power generation cost and its classification, fixed, semi fixed and running charges- Interest and depreciation, Load Curves-Load factors, connected load factor, utilization factor, plant capacity factor, plant use factor, load duration curve, load sharing between base load and peak load stations, predication of future loads.
**Tariff:** Types of tariffs, flat demand rate, block meter rate, two part tariff, power factor tariff, three part tariff. Concept of power factor, causes of low P.F. Power factor improvement techniques, Economics of P.F improvement, problems.

**Course Outcomes:**

CO1: Explain the principles of management and administration.
CO2: Discuss the various steps involved in planning, decision making, organizing and staffing
CO3: Apply the principles of directing and controlling for leadership qualities.
CO4: Discuss the various stages of entrepreneurial process.
CO5: Analyze the economic aspects of power generation.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Principles of Management | P.C.Tripathi, P.N.Reddy | McGraw Hill | 6th Edition, 2017 |
| 2 | Entrepreneurship Development And Small Business Enterprises | Poornima, M. Charanthimath | Pearson | 2nd Edition, 2014 |
| 3 | Art and science of Utilization of Electrical Energy | H. Partab | Dhanpat Rai & co | 3rd Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Dynamics of Entrepreneurial Development and Management | Vasant Desai | Himalaya Publishing House | 2007 |
| 2 | Essentials of Management: An International, Innovation and Leadership Perspective | Harold Koontz, Heinz Weihrich | McGraw Hill | 10th Edition, 2016. |

## Semester: VI
## Course Name: Power System Analysis-I

| | | | |
|---|---|---|---|
| PCC Course Code | **21EE62** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Module – 1** **08 Hours**

**Representation of Power System Components**
Introduction, Single-phase Representation of Balanced 3-Ø Networks, One-Line Diagram, Impedance and Reactance Diagrams, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of Electrical Power, Representation of Loads, per unit impedance diagram of power system.

**Module - 2** **08 Hours**

**Symmetrical Fault Analysis**
Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine (On No Load), Short Circuit of a Loaded Synchronous Machine, Illustrative simple examples on power systems. Selection of Circuit Breakers.

**Module – 3** **08 Hours**

**Symmetrical Components**
Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System.

**Module – 4** **08 Hours**

**Unsymmetrical Fault Analysis**
Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Faults in the alternator and on the power system with and without fault impedance. Series type Conductor Faults.

**Module – 5** **08 Hours**

**Power System Stability**
Introduction, Dynamics of a Synchronous Machine, Power Angle Equation for salient pole synchronous machine, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability, Multi machine stability studies,

**Course Outcomes:**
CO1: Model the power system components & construct per unit impedance diagram of power system.
CO2: Analyze three phase symmetrical faults on power system.
CO3: Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks.
CO4: Analyze various unsymmetrical faults on power system.
CO5: Examine dynamics of synchronous machine and determine the power system stability.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Elements of Power System | William D. Stevenson Jr | McGraw Hill | 4th Edition, 1982. |
| 2 | Entrepreneurship Development And Small Business Enterprises | Poornima, M. Charanthimath | Pearson | 2nd Edition, 2014 |
| **Reference Books** | | | | |
| 1 | Modern Power System | D. P. Kothari | McGraw Hill | 4th Edition, 2011. |
| 2 | Power System Analysis and Design | J.Duncan Glover et al | Cengage | 4th Edition, 2008. |
| 3 | Power System Analysis | Hadi Sadat | McGraw Hill | 1st Edition, 2002. |

## Semester: VI
## Course Name: Signals and Digital Signal Processing

| | | | |
|---|---|---|---|
| Course Code | **21EE63** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course objectives:**

1. To explain basic signals, their classification, basic operations on signals, and the properties of the systems.
2. To explain the convolution of signals in continuous and discrete time domain and the properties of impulse response representation.
3. To explain the computation of Discrete Fourier Transform of a sequence by direct method, Linear transformation Method and using Fast Fourier Transformation Algorithms.
4. To explain design of IIR all pole analog filters and transform them into digital filter using Impulse Invariant and Bilinear Transformation Techniques and to obtain their Realization.
5. To explain design of FIR filters and to obtain their Realization.

**Module – 1** **08 Hours**

**Introduction:** Definitions of a Signal and a System, Classification of Signals, Basic Operations on Signals, Basic Elementary Signals, properties of systems.
**Time-domain representations for LTI systems:** Convolution, impulse response representation.

**Module – 2** **08 Hours**

**Discrete Fourier Transforms (DFT):** Introduction to DFT, Properties of DFT, circular convolution, use of DFT in linear filtering, overlap-save and overlap-add method

**Module – 3** **08 Hours**

**Fast-Fourier-Transform (FFT) Algorithms:** Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and Decimation-in-frequency algorithms

**Module – 4** **08 Hours**

**IIR Filter Design:** Characteristics of commonly used analog filters – Butterworth and Chebyshev Type - I filters, analog to analog frequency transformations. Design of Digital IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Bilinear transformation method. Implementation of discrete-time systems.

**Module – 5** **08 Hours**

**FIR Filter Design:** Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Blackman window, FIR filter design using frequency sampling Technique. Implementation of discrete-time systems: Structures for Filters: IIR Filters - direct form I and direct form II, cascade and parallel structures. FIR filters-direct form, cascade and Linear Phase Form.

**Course Outcomes:**

Upon completion of this course, student will be able to:

CO1: Analyze different types of signals and perform various operations on signals.

CO2: Analyze the system properties and determine the system response using convolution

CO3: Evaluate Discrete Fourier Transform and Inverse Discrete Fourier Transform by direct computation and Fast Fourier Transform methods.

CO4: Design Butterworth and Chebyshev IIR filters and FIR filters using different techniques.

CO5: Develop different structures for IIR and FIR filters.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Signals and Systems | Oppenheim and Willsky. | Pearson India; | 2nd Edition, 2015 |
| 2 | Digital Signal Processing | Jhon G. Proakis Dimitris G. Manolakis, | Pearson, | 4th Edition, 2007. |
| 3 | Digital Signal Processing, | A.NagoorKani | McGraw Hill | 2nd Edition, 2012. |
| 4 | Power System Analysis and Design | J.Duncan Glover et al | Cengage | 4th Edition, 2008. |
| 5 | Digital Signal Processing | Shaila D. Apte | Wiley | 2nd Edition, 2009 |

## Semester: VI
## Course Name: Utilization of Electrical Power (Professional Electives)

| | | | |
|---|---|---|---|
| PE Course Code | **21EE641** | CIE Marks | **50** |
| Teaching Hours/Week(L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**
The knowledge of following subjects is essential to understand the subject:
1. Electrical Machines
2. Power Electronics and Drives
3. Power Systems –II

**Module – 1** **08 Hours**

Heating and welding: Modes of heat transfer, Electric Heating, Types of Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, and Heating of Buildings. Comparison of different types of welding.

**Module – 2** **08 Hours**

**Illumination:** Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting.

**Module – 3** **10 Hours**

**Electric Traction Speed-Time Curves and Mechanics of Train Movement:** Introduction, Systems of Traction, Systems of electric Traction, Speed -Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion.
**Motors for Electric traction:** Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power.
**Control of Motors:** Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors.

**Module – 4** **08 Hours**

**Braking:** Introduction, Regenerative Braking with Single phase and Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro– Mechanical Drum Brakes.
**Electric Traction Systems and Power Supply:** System of Electric Traction, AC Electrification, Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC Traction Feeding and Distribution System for DC Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires.

**Module – 5** **06 Hours**

**Trams, Trolley Buses and Diesel–Electric Traction:** Tramways, the Trolley–Bus, Diesel Electric Traction.
**Tariffs:** objective, factors affecting the tariff, types. Types of consumers and their tariff.

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Discuss different methods of electric heating & welding.
CO2: Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
CO3: Analyze systems of electric traction, speed time curves and mechanics of train movement.
CO4: Explain the motors used for electric traction, their control & braking and power supply system used for electric traction.
CO5: Explain the importance of the tariff and types of consumers.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A Text Book on Power System Engineering | A.Chakrabarti etal | Dhanpat Raiand Co. | 2nd Edition, 2010 |
| 2 | Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters04 and05 for module5) | Mehrdad Ehsani et al | CRCPress | 1st Edition, 2005 |
| **Reference Books** | | | | |
| 1 | Utilization, Generation and Conservation of Electrical Energy | Sunil S Rao Khanna | Publishers | 1st Edition, 2011 |
| 2 | Utilization of Electric Power and Electric Traction | G.C.Garg | Khanna Publishers | 9th Edition, 2014 |

## Semester: VI
## Course Name: Renewable Energy Sources (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | **21EE642** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P: S) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course objectives:**
1. To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
2. To discuss about solar energy reaching the Earth's surface and solar thermal energy applications.
3. To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
4. To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
5. To discuss wind turbines, wind resources, site selection for wind turbine.
6. To discuss geothermal systems, their classification and geothermal based electric power generation
7. To discuss waste recovery management systems, advantages and disadvantages.
8. To discuss biomass composition, production, types of biomass gasifiers, properties of producer gas benefits.
9. To discuss tidal energy resources, energy availability, power generation.

**Module – 1** **08 Hours**

**Introduction:** Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.
**Energy from Sun:** Sun-Earth Geometric Relationship, Layer of the Sun, Earth–Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications

**Module – 2** **08 Hours**

**Solar Thermal Energy Collectors:** Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.
**Solar Cells:** Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic panels (series and parallel arrays).

**Module – 3** **08 Hours**

**Hydrogen Energy:** Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.
**Wind Energy:** Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.
**Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.
**Solid waste and Agricultural Refuse:** Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics.

**Module – 4** **08 Hours**

**Biomass Energy:** Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.
**Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.
**Tidal Energy:** Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.

**Module – 5** **08 Hours**

**Sea Wave Energy:** Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.
**Ocean Thermal Energy:** Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC.

**Course outcome**

At the end of the course the student will be able to:

CO1: Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2: Outline energy from sun, energy reaching the Earth’s surface and solar thermal energy applications.
CO3: Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4: Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5: Discuss production of energy from biomass, biogas and Summarize tidal energy resources, sea wave energy and ocean thermal energy.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Nonconventional Energy Resources | Shobh Nath Singh | Pearson | 1st Edition, 2015. |
| **Reference Books** | | | | |
| 1 | Nonconventional Energy Resources | B.H. Khan | McGraw Hill | 3rd Edition |
| 2 | Renewable Energy; Power for a sustainable Future | Godfrey Boyle | Oxford | 3rd Edition, 2012. |
| 3 | Renewable Energy Sources: Their Impact on global Warming and Pollution | Tasneem Abbasi S.A. Abbasi | PHI | 1st Edition, 2011. |

## Semester: VI
## Course Name: Electric Vehicle Technology (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | 21EE643 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Pre-Requisite:**
Simulink Fundamentals, Simscape Onramp, Circuit Simulation Onramp, Power Electronics Simulation Onramp, Control Design Onramp,

**Course Outcomes:**

**Module – 1** **08 Hours**

**Introduction to Electric Vehicle Systems:** Model Based System Engineering for Electric Vehicles; Comparison between conventional internal combustion engine vehicles and electric vehicles; EV architecture and powertrain configurations: series, parallel, and hybrid systems- Electric vehicle architectures: Battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), Fuel Cell Electric Vehicles (FCEVs) and plug-in hybrid electric vehicles (PHEVs);Understanding and capturing requirements for an electric vehicle; Translating and refining requirements into architectures; Components of an electric vehicle system: battery, electric motor, power electronics and control systems; Modelling and simulation of EV powertrain components using Simulink.

**Module – 2** **08 Hours**

**Electric Vehicle Propulsion Systems** Electric motor technologies for electric vehicles: Induction motors, permanent magnet synchronous motors, brushless DC motors and switched reluctance motors; Modelling motor at different fidelities using Simulink and Simscape; Studying different motor characteristics, Selection and sizing of motors for EV applications; Motor control techniques: field-oriented control, direct torque control, and sensorless control; Transmission systems in electric vehicles: single-speed, multi-speed, and direct drive configurations; Regenerative braking systems and energy recovery in electric vehicles; Modelling of Brake Control Unit, System level modeling and control of electric vehicle propulsion systems

**Module – 3** **08 Hours**

**Power Electronics for Electric Vehicle:** Power electronics in electric vehicle systems: requirements, and challenges - DC-DC converters, DCAC inverters, and AC-DC rectifiers; Design considerations and control strategies for power electronic converters in EV applications.

**Module – 4**

**Energy Storage Systems for Electric Vehicles:** Lithium-ion batteries, fuel cells, ultra-capacitors, and their characteristics. Modelling Lithium Ion Batteries using equivalent circuit approach, Calculation of Electric Vehicle Battery Capacity, scale up from Battery to Pack, Development of Battery management systems (BMS): State-of-charge (SoC) estimation, balancing, and protection. Thermal management of power electronics in electric vehicles.

**Module – 5** **08 Hours**

**Electric Vehicle Charging and Integration with Microgrids:** DC charging, AC charging, Fast charging station, Wireless charging, Charging standards and protocols: CCS, Bharat DC 001, Bharat AC 001, Smart grid integration and vehicle-to-grid (V2G) technologies.

**Course Outcomes:**

CO1: Explain the electric vehicle technology and its components at the system level, different EV architectures, and powertrain configurations.

CO2: Learn about electric motor technologies. Build models using first principles and data driven approach for electric motors, design control techniques for motors and integrate with electric vehicle propulsion systems.

CO3: Analyze and design power electronic converters.

CO4: Develop and analyze the battery storage systems, fuel cell systems (FCS) and fuel cell control systems (FCCS).

CO5: Discuss the application issues of Electric Vehicle Charging, Infrastructure, standards and integration with Microgrids.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Electric powertrain: energy systems, power electronics & drives for hybrid, electric & fuel cell vehicles" | Goodarzi, Gordon A., Hayes, John G | Wiley | 2018 |
| 2 | "Electric Vehicle Technology Explained, " | James Larminie and John Lowry | John Wiley & Sons Ltd, | 2003 |
| **Reference Books** | | | | |
| 1 | "Modeling for Hybrid and Electric Vehicles Using Simscape (Synthesis Lectures on Advances in Automotive Technology)" | Shuvra Das | Morgan & Claypool Publishers | 2021 |
| 2 | "Grid Optimal Integration of Electric Vehicles: Examples with MATLAB Implementation" | Andrés Ovalle, Ahmad Hably, Gipsa-lab, Seddik Bacha, Grenoble INP, G2Elab | Springer International Publishing, | 2018 |

## Semester: VI
## Course Name: Energy Storage Systems (Professional Elective)

| | | | |
|---|---|---|---|
| PE Course Code | 21EE644 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Module – 1** **08 Hours**

**Introduction to energy storage for power systems:** Role of energy storage systems, applications.

**Module – 2** **08 Hours**

**Overview of energy storage technologies:** Thermal, Mechanical, Chemical, Electrochemical, Electrical. Efficiency of energy storage systems

**Module – 3** **08 Hours**

**Electrical energy storage:** Batteries, Super capacitors, Superconducting Magnetic Energy Storage (SMES), charging methodologies, SoC, SoH estimation techniques. Hydrogen production and storage, fuel cells.

**Module – 4** **08 Hours**

**Mobile storage system:** electric vehicle, G2V, V2G.
**Hybrid Energy storage systems:** configurations and applications.

**Module – 5** **08 Hours**

**Storage for renewable energy systems:** Solar energy, Wind energy, Pumped hydro energy, fuel cells. Energy storage in Micro-grid and Smart grid. Energy Management with storage systems, Battery SCADA, Increase of energy conversion efficiencies by introducing energy storage.

**Course Outcomes:**

1. Explain the working of electric vehicles and recent trends.
2. Analyze different power converter topology used for electric vehicle application.
3. Discuss the electric propulsion unit and its control for application of electric vehicles.
4. Analyze the operation of battery management systems.
5. Discuss the construction and performance of different types of hydrogen and fuel cells.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Energy Storage for Power Systems. | A.G.Ter-Gazarian, | The Institution of Engineering and Technology (IET) | 2nd Edition, 2011 |
| 2 | Energy Storage in Power Systems | Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt | Wiley | 2016. |
| **Reference Books** | | | | |
| 1 | Energy Storage Science and Technology | A. R. Pendse | SBS Publishers & Distributors Pvt. Ltd. | 2011 |
| 2 | The Role of Energy Storage with Renewable Electricity Generation | Paul Denholm, Erik Ela, Brendan Kirby and Michael Milligan | National Renewable Energy Laboratory (NREL) – A National Laboratory of the U.S. Department of Energy – Technical Report NREL/ TP6A2-47187 | 2010 |

## Semester: VI
## Course Name: Energy Storage Technologies for EV (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | 21EE651 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

1. To understand working of Electric Vehicles and recent trends.
2. To discuss different batteries used for electric vehicle application.
3. To analyze the characteristics of various batteries used in EV.
4. To discuss the electric propulsion unit and its control for application of electric vehicles.
5. To explain the construction and performance of different types of hydrogen and fuel cells.

**Module – 1** **08 Hours**

**Electric vehicle Mechanism:** Basics of vehicle mechanisms, history of electric vehicles (EV) and hybrid electric vehicles (HEV), need for and Importance of EV and HEV, Power/Energy supply requirements.

**Module – 2** **08 Hours**

**Electrical Energy Storage:** Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage Systems.

**Module – 3** **08 Hours**

**Batteries for Electric Vehicles:** Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery **Management System:** Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests.

**Module – 4** **08 Hours**

**Chemical & Structure Material** properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents, Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.

**Module – 5** **08 Hours**

**Hydrogen and Fuel cell based EVT:** Introduction to hydrogen energy, various hydrogen production methods, types of electrolyzer: proton-exchange membrane, alkaline, solid oxide, alkaline, microbial, efficiency, open circuit voltage, and losses, type of fuel cells: proton-exchange membrane, alkaline, anion exchange membrane, solid oxide, microbial, storage, fueling fuel cell, component of fuel cells, fuel cell calculations, fuel-cell electric vehicle and applications.

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Explain the working of electric vehicles and recent trends.
CO2: Analyze different power converter topology used for electric vehicle application.
CO3: Discuss the electric propulsion unit and its control for application of electric vehicles.
CO4: Analyze the operation of battery management systems.
CO5: Discuss the construction and performance of different types of hydrogen and fuel cells.

**Text Book**

1. B Sorensen, G Spazzafumo, Hydrogen and Fuel Cells: Emerging Technologies and Applications, 3 rd Edition, Academic Press, 2018.

## Semester: VI
## Course Name: Utilization of Electrical Power (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | **21EE652** | CIE Marks | **50** |
| Teaching Hours/Week(L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Pre-Requisites:**
The knowledge of following subjects is essential to understand the subject:
1. Electrical Machines
2. Power Electronics and Drives
3. Power Systems –II

**Module – 1** **08 Hours**

**Heating and Welding:** Modes of heat transfer, Electric Heating, Types of Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, and Heating of Buildings. Comparison of different types of welding.

**Module – 2** **08 Hours**

**Illumination:** Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting.

**Module – 3** **08 Hours**

**Electric Traction Speed-Time Curves and Mechanics of Train Movement:** Introduction, Systems of Traction, Systems of electric Traction, Speed -Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion.
**Motors for Electric Traction:** Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power.
**Control of Motors:** Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors.

**Module – 4** **08 Hours**

**Braking:** Introduction, Regenerative Braking with Single phase and Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro– Mechanical Drum Brakes.
**Electric Traction Systems and Power Supply:** System of Electric Traction, AC Electrification, Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC Traction Feeding and Distribution System for DC Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires.

**Module – 5** **08 Hours**

**Trams, Trolley Buses and Diesel–Electric Traction:** Tramways, the Trolley–Bus, Diesel Electric Traction.
**Tariffs:** objective, factors affecting the tariff, types. Types of consumers and their tariff.

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Discuss different methods of electric heating & welding.

CO2: Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.

CO3: Analyze systems of electric traction, speed time curves and mechanics of train movement.

CO4: Explain the motors used for electric traction, their control & braking and power supply system used for electric traction.

CO5: Explain the importance of the tariff and types of consumers.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A Text Book on Power System Engineering | A.Chakrabarti etal | Dhanpat Raiand Co | 2nd Edition, 2010 |
| 2 | Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters04 and05 for module5) | Mehrdad Ehsani et al | CRC Press | 1st Edition, 2005 |
| **Reference Books** | | | | |
| 1 | Utilization, Generation and Conservation of Electrical Energy | Sunil S Rao Khanna | Publishers | 1st Edition, 2011 |
| 2 | Utilization of Electric Power and Electric Traction | G.C.Garg | Khanna Publishers | 9th Edition, 2014 |

## Semester: VI
## Course Name: Industrial Servo Control Systems (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | **21EE653** | CIE Marks | **50** |
| Teaching Hours/Week(L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course Objectives:**

1. To explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
2. To discuss system analogs and vectors, with a review of differential equations.
3. To discuss the concept of transfer functions for the representation of differential equations.
4. To discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
5. To represent servo drive components by their transfer function, to combine the servo drive building blocks into system block diagrams.

**Module – 1** **08 Hours**

**Servos:** Introduction, Benefits of Servo Systems, Types of Servos - Evolution of Servo Drives, Classification of Drives, Components of Servos - Hydraulic/Electric Circuit Equations, Actuators- Electric, Actuators-Hydraulic, Amplifiers-Electric, Amplifiers-Hydraulic, Transducers (Feedback).

**Module – 2** **08 Hours**

**Machine Servo Drives:** Types of Drives, Feed Drive Performance.
**Troubleshooting Techniques:** Techniques by Drive, Problems: Their Causes and Cures.
**Machine Feed Drives:** Advances in Technology, Parameters for making Application Choices.
**Application of Industrial Servo Drives:** Introduction, Physical System Analogs, Quantities and Vectors, Differential Equations for Physical Systems, Electric Servo Motor Transfer Functions and Time Constants, Transport Lag Transfer Function, Hydraulic Servo Motor Characteristics, General Transfer Characteristics.

**Module – 3** **08 Hours**

**Generalized Control Theory:** Servo Block Diagrams, Frequency-Response Characteristics and Construction of Approximate (Bode) Frequency Charts, Nichols Charts, Servo Analysis Techniques, Servo Compensation.
**Indexes of Performance:** Definition of Indexes of Performance for Servo Drives, Indexes of Performance for Electric and Hydraulic Drives.

**Module – 4** **08 Hours**

**Performance Criteria:** Percent Regulation, Servo System Responses.
**Servo Plant Compensation Techniques:** Dead-Zone Nonlinearity, Change-in-Gain Nonlinearity, Structural Resonances, Frequency Selective Feedback, Feed forward Control. Machine Considerations: Machine feed drive Considerations, Ball Screw Mechanical Resonances and Reflected Inertias for Machine Drives.

**Module – 5** **08 Hours**

**Machine Considerations:** Drive Stiffness, Drive Resolution, Drive Acceleration, Drive Speed Considerations, Drive Ratio Considerations, Drive Thrust/Torque And Friction Considerations, Drive Duty Cycles.

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.

CO2: Discuss system analogs, vectors and transfer functions of differential equations.

CO3: Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.

CO4: Represent servo drive components by their transfer function, to combine the servo drive building blocks into system block diagrams.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Industrial Servo Control Systems Fundamentals and Applications | George W. Younkin, Marcel Dekker | -- | 1st Edition, 2003. |
| **Reference Books** | | | | |
| 1 | Servo Motors and Industrial Control Theory | Riazollah Firoozian | Springer | 2nd Edition, 2014. |
| 2 | DC SERVOS Application and Design with MATLAB | Stephen M. Tobin | CRC | 1st Edition, 2011 |

## Semester: VI
## Course Name: Advanced Control Systems (Open Elective)

| | | | |
|---|---|---|---|
| OE Course Code | **21EE653** | CIE Marks | **50** |
| Teaching Hours/Week(L:T:P) | **2:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**Course Objectives:**
1. To introduce state variable approach for linear time invariant systems in both the continuous and discrete time systems
2. To explain development of state models for linear continuous – time and discrete – time systems.
3 To explain application of vector and matrix algebra to find the solution of state equations for linear continuous – time and discrete – time systems.
4. To define controllability and observability of a system and testing techniques for controllability and observability of a given system.
5. To explain design techniques of pole assignment and state observer using state feedback.
6. To explain about inherent and intentional nonlinearities that can occur in control system and developing the describing function for the nonlinearities.
7. To explain stability analysis of nonlinear systems using describing function analysis.
8. To explain the analysis of nonlinear systems using Lyapunov function and design of Lyapunov function for stable systems.

**Module – 1** **08 Hours**

**State Variable Analysis and Design:** Introduction, Concept of State, State Variables and State Model, State Models for Linear Continuous–Time Systems, State Variables and Linear Discrete– Time Systems.

**Module – 2** **08 Hours**

**State Variable Analysis and Design (continued):** Diagonalization, Solution of State Equations, Concepts of Controllability and Observability.

**Module – 3** **08 Hours**

**Pole Placement Design and State Observers:** Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, State Regulator Design, Design of State Observer, Compensator Design by the Separation Principle.

**Module – 4** **08 Hours**

**Non-linear systems Analysis:** Introduction, Common Nonlinear System Behaviours, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane.

**Module – 5** **08 Hours**

**Non-linear systems Analysis (continued):** Simple Variable Structure Systems, Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems, linear continuous–time and discrete–time systems.

CO2: Analyze and Design controllability and observability of a system and test for controllability and observability of a given system.

CO3: Design pole assignment and state observer using state feedback.

CO4: Develop the describing function for the nonlinearity present to assess the stability of the system.

CO5: Develop Lyapunov function for the stability analysis of nonlinear systems.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Control Systems Engineering | I. J. Nagarath and M.Gopal | New Age | 5$^{th}$ Edition, 2007 |
| 2 | Digital Control and State Variable Methods: Conventional and Intelligent Control Systems | M.Gopal | Mc GrawHill | 3$^{rd}$ Edition, 2008. |
| **Reference Books** | | | | |
| 1 | Modern Control Theory | R. V. Parvatikar | Prism Books Pvt. Ltd | 1$^{st}$ Edition, 2014 |

## Semester: VI
## Course Name: Digital Signal Processing Laboratory

| | | | |
|---|---|---|---|
| PCC Course Code | **21EEL66** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:3** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

| SN | List of Experiments |
|---|---|
| 1 | Verification of Sampling Theorem both in time and frequency domains |
| 2 | Evaluation of impulse response of a system. |
| 3 | Solution of a difference equation. |
| 4 | Evaluation of linear convolution and circular convolution of given sequences. |
| 5 | Computation of N- point DFT and IDFT of a given sequence by use of (a) Defining equation; (b) FFT method. |
| 6 | Evaluation of circular convolution of two sequences using DFT and IDFT approach. |
| 7 | Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters). |
| 8 | Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using different window functions. |
| 9 | Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique. |
| 10 | Realization of IIR and FIR filters. |
| | **Open ended Experiments** |
| 1 | Generation of different signals in both continuous and discrete time domains. |
| 2 | To perform basic operations on given sequences- Signal folding, evaluation of even and odd |

**Course Outcomes:**

CO1: Evaluate the impulse response of a system.
CO2: Perform convolution of given sequence to evaluate the response of a system.
CO3: Compute DFT and IDFT of a given sequence using the basic definition and fast method
CO4: Provide a solution for a given difference equation.
CO5: Design and implement IIR and FIR filters.

## Semester: VI
## Course Name: Computer Aided Electrical Drawing

| | | | |
|---|---|---|---|
| PCC Code | **21EEL67** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **03** | Exam Hours | **03** |

**MODULE – 1** **08 Hours**

**Winding Diagrams:**
(a) Developed winding diagrams of D.C. machines – Simplex and multiplex double layer Lap and Wave windings.
(b) Developed winding diagrams of A.C. machines: Integral and Fractional slot double layer Lap and Wave windings.

**MODULE – 2** **08 Hours**

**Single line diagrams of generating stations and substations.**
Covering Incoming Circuits, Outgoing Circuits, Bus bar Arrangements (Single, Sectionalized Single, Main and transfer, Double bus double Breaker, Sectionalized Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Lightning Arresters, Communication Devices (Power-Line Carrier) and Line trap.

**MODULE – 3** **08 Hours**

**Electrical machine assembly drawing using designs data or sketches or both:**
Transformers - Sectional Views Of Single And Three Phase Core And Shell Type Transformers

**MODULE – 4** **08 Hours**

**Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:**
D.C. Machine – Sectional Views of Yoke with Poles, Armature and Commutator dealt separately.

**MODULE – 5** **08 Hours**

**Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:**
Alternator-Sectional Views of Stator and Rotor dealt separately.

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Develop the armature winding diagram for DC and AC machines
CO2: Develop a Single Line Diagram of Generating Stations and substation using the standard symbols.
CO3: Construct the sectional views of core and shell types transformers using the design data
CO4: Construct the sectional views of assembled DC machine and their parts using the design data or the sketches.
CO5: Develop the sectional views of assembled AC machine and their parts using the design data or the sketches.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A course in Electrical Machine design | A. K. Sawhney. | Dhanpat Rai | 6th Edition, 2013 |
| 2 | Electrical Engineering Drawing | K. L. Narang | Satya Prakashan | 2014 |

## Semester: VI
## Course Name: Modeling and Simulation of Electric Vehicle System using MATLAB

| | | | |
|---|---|---|---|
| PE Course Code | **21AEC690** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P: S) | **0:2:0** | SEE Marks | **50** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |
| Credits | **01** | Exam Hours | **03** |

| SN | Experiment |
|---|---|
| 1 | Modelling and simulation of EV powertrain components using Simulink. |
| 2 | Modelling motor at different fidelities using Simulink and Simscape. |
| 3 | Modelling of Brake Control Unit. |
| 4 | System level modelling and control of electric vehicle propulsion systems. |
| 5 | Modelling Lithium Ion Batteries using equivalent circuit approach. |
| 6 | Modelling of Battery Management System. |

**Course Outcomes:**
CO1: Model and simulate EV powertrain components using Simulink.
CO2: Model and simulate motor at different fidelities.
CO3: Model and simulate Brake Control Unit.
CO4: Model and simulate electric vehicle propulsion systems.
CO5: Model and simulate the Battery Management System.

## TEACHING-LEARNING PROCESS

The Course faculty and students are recommended to follow the appropriate strategies to facilitate teaching and learning process. The following are some of the suggested teaching-learning methods but not limited to:

- Black board presentation
- Power Point Presentation
- Demonstration through YouTube videos
- Demonstration through ICT Tools / Simulation tools / Virtual Labs Industrial Visits
- Self-Study, Case Study
- Flipped Class Room, Google Class Room

## Assessment Details

**1. Integrated professional Core Courses (IPCC):**

**CIE for the Theory component of IPCC: 30 Marks**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| 1 | Tests (A) | 3 | 60% | 18 |
| 2 | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 12 |
| X | **Total Marks for theory component A+B** | | | **30** |

**CIE for the LAB component of IPCC: 20 Marks**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| 1 | Lab Work: Conduction of Experiments (A) | 40% | **08** |
| 2 | Lab Journal Writing & Submission (B) | 10% | **02** |
| 3 | Lab Test (C) | 30% | **06** |
| 4 | Open-Ended Experiments / Course Projects (D) | 20% | **04** |
| **Y** | **Total Marks** | | **20** |

***Final Marks for IPCC Courses = X + Y = 30 + 20 = 50***

**SEE for IPCC Theory for 3 hours duration**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component)
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

## 2. Professional Core / Basic Science Courses (PCC / BSC) Theory:

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B) = 30 + 20 = 50**
**Semester End Examination (SEE)**

**Question Paper Pattern:**

- The question paper will have ten full questions carrying equal marks. Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module. Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

## 3. Professional Core Course (PCC) Lab:

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | **20** |
| (ii) | Lab Journal Writing & Submission (B) | 10% | **05** |
| (iii) | Lab Test (C) | 30% | **15** |
| (iv) | Open-Ended Experiments (D) | 20% | **10** |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.
4. Marks distribution: Procedure (15%) + Execution (70%) + Viva Voce (15%)

## 4. Ability Enhancement Course (AEC):

**Continuous Internal Evaluation (CIE):**

| | Components | Weightage | Max. Marks |
|---|---|---|---|
| (i) | Lab Work: Conduction of Experiments (A) | 40% | **20** |
| (ii) | Lab Journal Writing & Submission (B) | 10% | **05** |
| (iii) | Lab Test (C) | 30% | **15** |
| (iv) | Open-Ended Experiments (D) | 20% | **10** |
| | **Total Marks: A+B+C+D** | | **50** |

**Semester End Evaluation (SEE):**

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to be made zero.

**Marks Distribution: Procedure** (15%) + **Execution** (70%) + **Viva Voce** (15)

## VII SEMESTER DETAILED SYLLABUS

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**POWER SYSTEM ANALYSIS – 2(Core Course)**

| | | | |
|---|---|---|---|
| Course Code | **18EE71** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 2:2:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To explain formulation of network models and bus admittance matrix for solving load flow problems.
- To discuss optimal operation of generators on a bus bar and optimum generation scheduling.
- To explain symmetrical fault analysis and algorithm for short circuit studies.
- To explain formulation of bus impedance matrix for the use in short circuit studies on power systems.
- To explain numerical solution of swing equation for multi-machine stability

**Module-1**

**Network Topology**: Introduction and basic definitions of Elementary graph theory Tree, cut-set, loop analysis. Formation of Incidence Matrices. Primitive network- Impedance form and admittance form, Formation of Y Bus by Singular Transformation. $Y_{bus}$ by Inspection Method. Illustrative examples. ■ T1,2

**Module-2**

**Load Flow Studies:** Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow, Gauss Seidal iterative method. Illustrative examples. ■ T1, R1

**Module-3**

**Load Flow Studies(continued)** Newton-Raphson method derivation in Polar form, Fast decoupled load flow method, Flow charts of LFS methods. Comparison of Load Flow Methods. Illustrative examples.■ T1, R1

**Module-4**

**Economic Operation of Power System:** Introduction and Performance curves Economic generation scheduling neglecting losses and generator limits Economic generation scheduling including generator limits and neglecting losses Economic dispatch including transmission losses Derivation of transmission loss formula. Illustrative examples.T1

**Unit Commitment:** Introduction, Constraints and unit commitment solution by prior list method and dynamic forward DP approach (Flow chart and Algorithm only). ■ T3

**Module-5**

**Symmetrical Fault Analysis**: Z Bus Formulation by Step by step building algorithm without mutual coupling between the elements by addition of link and addition of branch. Illustrative examples.Z bus Algorithm for Short Circuit Studies excluding numerical.T1

**Power System Stability:** Numerical Solution of Swing Equation by Point by Point method and Runge Kutta Method. Illustrative examples. ■ T1

**Course Outcomes:** At the end of the course the student will be able to:

- Formulate network matrices and models for solving load flow problems.
- Perform steady state power flow analysis of power systems using numerical iterative techniques.
- Solve issues of economic load dispatch and unit commitment problems.
- Analyze short circuit faults in power system networks using bus impedance matrix.
- Apply Point by Point method and Runge Kutta Method to solve Swing Equation. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

  Module 1 $Y_{Bus}$ Matrix size limited to 3X3 for illustrative examples.

  Module 2 NR Method limited to 3 bus system with one iteration for illustrative examples.

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Modern Power System Analysis | D P Kothari, I J Nagrath | McGraw Hill | 4th Edition, 2011 |
| 2 | Computer Methods in Power Systems Analysis | Glenn W. Stagg Ahmed H Ei - Abiad | Scientific International Pvt. Ltd. | 1st Edition, 2019 |
| 3 | Power Generation Operation and Control | Allen J Wood etal | Wiley | 2nd Edition,2016 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Computer Techniques in Power System Analysis | M.A. Pai | McGraw Hill | 2nd Edition, 2012 |
| 2 | Power System Analysis | Hadi Saadat | McGraw Hill | 2ndEdition, 2002 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**POWER SYSTEM PROTECTION (Core Subject)**

| | | | |
|---|---|---|---|
| Course Code | **18EE72** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss performance of protective relays, components of protection scheme and relay terminology.
- To explain relay construction and operating principles.
- To explain Over current protection using electromagnetic and static relays and Over current protective schemes.
- To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays.
- To discuss pilot protection; wire pilot relaying and carrier pilot relaying.
- To discuss construction, operating principles and performance of various differential relays for differential protection.
- To discuss protection of generators, motors, Transformer and Bus Zone Protection.
- To explain the principle of circuit interruption and different types of circuit breakers.
- To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse.
- To discuss protection Against Over voltages and Gas Insulated Substation (GIS).

**Module-1**

**Introduction to Power System Protection:** Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.
**Relay Construction and Operating Principles:** Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.
**Overcurrent Protection:** Introduction, Time – current Characteristics, Current Setting, Time Setting.

**Module-2**

**Overcurrent Protection (continued):** Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.
**Distance Protection:** Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges(Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays.

**Module-3**

**Pilot Relaying Schemes:** Introduction, Wire Pilot Protection, Carrier Current Protection
**Differential Protection**: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.
**Rotating Machines Protection:** Introduction, Protection of Generators.
**Transformer and Buszone Protection:** Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection.

**Module-4**

**Circuit Breakers:** Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, $SF_6$ Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. ■

**Module-5**

**Fuses:** Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination.

**Protection against Overvoltages:** Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL).

**Modern Trends in Power System Protection:** Introduction, gas insulated substation/switchgear (GIS). ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss performance of protective relays, components of protection scheme and relay terminology over current protection.
- Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.
- Discuss pilot protection, construction, operating principles and performance of differential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.
- Explain the construction and operation of different types of circuit breakers.
- Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Power System Protection and Switchgear | Badri Ram, D.N. Vishwakarma | McGraw Hill | 2nd Edition |
| 2 | Power System Protection and Switchgear | BhuvaneshOza et al | McGraw Hill | 1st Edition, 2010 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Protection and Switchgear | Bhavesh et al | Oxford | 1st Edition, 2011 |
| 2 | Power System Switchgear and Protection | N. Veerappan S.R. Krishnamurthy | S. Chand | 1st Edition, 2009 |
| 3 | Fundamentals of Power System Protection | Y.G.Paithankar S.R. Bhide | PHI | 1st Edition, 2009 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**SOLAR AND WIND ENERGY (Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE731** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss the importance of energy in human life, relationship among economy and environment with energy use.
- To discuss the increasing role of renewable energy, energy management, energy audit, energy efficiency, energy intensity.
- To discuss energy consumption status in India, energy saving potential and energy conservation efforts in India.
- To explain the concept of energy storage and the principles of energy storage devices.
- To discuss the characteristics and distribution of solar radiation, measurement of components of solar radiation and analysis of collected solar radiation data.
- To explain availability of solar radiation at a location and the effect of tilting the surface of collector with respect to horizontal surface.
- To describe the process of harnessing solar energy in the form of heat and working of solar collectors.
- To discuss applications of solar energy including heating and cooling.
- To discuss the operation of solar cell and the environmental effects on electrical characteristics of solar cell
- To discuss sizing and design of typical solar PV systems and their applications.
- To discuss basic Principles of Wind Energy Conversion and to compute the power available in the wind.
- To discuss forces on the Blades, Wind Energy Conversion, collection of Wind Data, energy estimation and site selection.
- To discuss classification of WEC Systems, its advantages and disadvantages of WECS, and Types of Wind Machines (Wind Energy Collectors).
- To evaluate the performance of Wind-machines, Generating Systems. ∎

**Module-1**

**Fundamentals of Energy Science and Technology:** Introduction, Energy, Economy and Social Development, Classification of Energy Sources, Importance of Non -conventional Energy Sources, Salient features of Non-conventional Energy Sources, World Energy Status, Energy Status in India. **Energy Conservation and Efficiency:** Introduction, Important Terms and Definitions, Important Aspects of Energy Conservation, Global Efforts, Achievements and Future Planning, Energy Conservation/Efficiency Scenario in India, Energy Audit, Energy Conservation Opportunities.

**Energy Storage:** Introduction, Necessity of Energy Storage, Specifications of Energy Storage Devices. **Solar Energy-Basic Concepts:** Introduction, The Sun as Source of Energy, The Earth, Sun, Earth Radiation Spectrum, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, Depletion of Solar Radiation. ∎

**Module-2**

**Solar Energy-Basic Concepts (continued):** Measurement of Solar Radiation, Solar Radiation Data, Solar Time, Solar Radiation Geometry, Solar Day Length, Extraterrestrial Radiation on Horizontal Surface, Empirical Equations for Estimating Terrestrial Solar Radiation on Horizontal Surface, Solar Radiation on Inclined Plane Surface.

**Solar Thermal Systems:** Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers. ∎

**Module-3**

**Solar Photovoltaic Systems:** Introduction, Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell Technologies, Solar Cell, Module, and Array Construction, Maximizing the Solar PV Output and Load Matching. Maximum Power Point Tracker. Balance of System Components, Solar PV Systems, Solar PV Applications. ■

**Module-4**

**Wind Energy**: Introduction, Basic Principles of Wind Energy Conversion, History of Wind Energy, Wind Energy Scenario – World and India. The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations **Wind energy systems:** Environment and Economics Environmental benefits and problems of wind energy, Economics of wind energy, Factors influence the cost of energy generation, machine parameters, Life cycle cost analysis ■

**Module-5**

**Basic Components of a Wind Energy Conversion(WEC) System:** Classification of WEC systems, Advantages and Disadvantages of WECS, Types of Wind Machines (Wind Energy Collectors), Analysis of Aerodynamic Forces Acting on the Blade, Performance of Wind- machines, Generating Systems, Energy Storage, Applications of Wind Energy, Environmental Aspects. ■

**Course Outcomes:**

At the end of the course the student will be able to:

- Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices.
- Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system.
- Describe the process of harnessing solar energy and its applications in heating and cooling.
- Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection.
- Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

| Textbook | | | | |
|---|---|---|---|---|
| 1 | Non-Conventional Energy Resources | B. H. Khan | McGraw Hill | 2nd Edition 2017 |
| 2 | Non-Conventional Sources of Energy | Rai G. D. | Khanna Publishers | 4th Edition, 2009 |
| **Reference Books** | | | | |
| 1 | Non-Conventional Energy Resources | ShobhNath Singh | Pearson | 1st Edition, 2015 |
| 2 | Solar Energy – Principles of Thermal Collections and Storage | S.P. Sukhatme J.K.Nayak | McGraw Hill | 3rd Edition, 2008 |
| 3 | Wind Turbine Technology | Ahmad Hemami | Cengage | 1st Edition, 2012 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **SENSORS AND TRANSDUCERS (Professional Elective)** | | | |
| Course Code | **18EE732** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss need of transducers, their classification, advantages and disadvantages.
- To discuss working of different types of transducers and sensors.
- To discuss recent trends in sensor technology and their selection.
- To discuss basics of signal conditioning and signal conditioning equipment.
- To discuss configuration of Data Acquisition System and data conversion. To discuss the basics of Data transmission and telemetry.
- To explain measurement of various non-electrical quantities. ■

**Module-1**

**Sensors and Transducers:** Introduction, Classification of Transducers**,** Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers. ■

**Module-2**

**Sensors and Transducers (continued):** Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems. ■

**Module-3**

**Signal Condition:**Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.

**Data Acquisition Systems and Conversion:**Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. ■

**Module-4**

**Data Transmission and Telemetry:**Data/Signal Transmission, Telemetry.

**Measurement of Non – Electrical Quantities:**Pressure Measurement. ■

**Module-5**

**Measurement of Non – Electrical Quantities (continued):**Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
- Explain the working of various transducers and sensors.
- Outline the recent trends in sensor technology and their selection.
- Analyze the signal conditioning and signal conditioning equipment.
- Illustrate different configuration of Data Acquisition System and data conversion.
- Show knowledge of data transmission and telemetry.
- Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Electrical and Electronic Measurements and instrumentation | R.K Rajput | S. Chand | 3rd Edition, 2013. |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | A Course in Electronics and Electrical Measurements and Instruments | J.B. Gupta | Katson Books | 13th Edition, 2008 |
| 2 | A Course in Electrical and Electronic Measurements and Instrumentation | A. K. Sawheny | DhanpatRai | 2015 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE733** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To explain power generation by alternate energy source like wind power and solar power.
- To explain selection of size of units and location for wind and solar systems.
- Discuss the effects of integration of distributed generation on the performance the system.
- To provide practical and useful information about grid integration of distributed generation.

**Module-1**

**Distributed Generation**: Introduction, status, Properties of wind power, Power Distribution as a function of wind speed, Solar Power: Status, Properties, Space requirements, Photovoltaic's, Seasonal variation in production capacity, Combined Heat-and-Power: Status, Options for space Heating, Hydropower: Properties of Large Hydro, Properties of small Hydro, Variation with time, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plant. ■

**Module-2**

**Distributed Generation(continued):**Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity. Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Active Power Flow Only, Active and Reactive Power Flow Overloading: Redundancy and Meshed Operation Redundancy in Distribution Networks Meshed Operation, Losses.■

**Module-3**

**Over loading and Losses (continued):**Increasing the Hosting Capacity: Increasing the Loadability Building New Connections, Inter trip Schemes, Advanced protection Schemes, Energy Management Systems. Power Electronics approach, Demand Control, Prioritizing Renewable Energy, Dynamic Loadability.

Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Marginand Hosting Capacity: Voltage Control in Distribution Systems, Voltage Rise Owing to Distributed Generation, Hosting Capacity, Estimating hosting capacity without Measurements, Sharing hosting capacity. Design of Distribution Feeders: Basic Design Rules, Terminology, An Individual Generator Along a Medium-Voltage Feeder, Low voltage feeders, Series and Shunt Compensation, A Numerical Approach to Voltage Variations: Example for Two-stage Boosting, General Expressions for Two-Stage Boosting Tap Changers with Line- Drop Compensation: Transformer with One Single Feeder, Adding a Generator.ProbabilisticMethodsforDesignofDistributionFeeders:Need for Probabilistic Methods, The System Studied, Generation with Constant Production, Adding Wind Power■

**Module-4**

**VoltageMagnitudeVariations(continued):**StatisticalApproachtoHostingCapacity,IncreasingtheHostingCapacity: New or Stronger Feeders, Alternative Methods for Voltage Control Accurate Measurement of the Voltage Magnitude Variations, Allowing Higher Overvoltage's Overvoltage Protection, Over Voltage Curtailment Compensating the generators voltage variations, Distributed generation with voltage control, Coordinated voltage control.

**Power Quality Disturbances:** Impact of Distributed Generation, Fast Voltage Fluctuations: Fast Fluctuations in Wind Power, Fast Fluctuations in Solar Power, Rapid Voltage Changes, Very Short Variations. Voltage Unbalance :Weaker Transmission System, Stronger Distribution System, Large Single-Phase Generators, Stronger Distribution Grid VoltageUnbalance. ■

**Module-5**

**Power Quality Disturbances(continued):** Low-Frequency Harmonics: Wind Power: Induction Generators, Generators with Power Electronics Interfaces, Synchronous Generators, Measurement Example, Harmonic Resonances, Weaker Transmission Grid, Stronger Distribution Grid. High-Frequency Distortion: Emission by Individual Generators, Grouping Below and Above 2 kHz, Limits Below and Above 2 kHz,Voltage Dips: Synchronous Machines Balanced Dips and Unbalanced Dips, Induction generators and unbalanced dips. Increasing the Hosting Capacity: Strengthening the Grid, Emission Limits for Generator Units, Emission Limits for Other Customers, Higher Disturbance Levels, Passive Harmonic Filters, Power Electronics Converters, Reducing the Number of Dips, Broadband and High-Frequency Distortion. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain energy generation by wind power and solar power.
- Discuss the variation in production capacity at different time scales,the size of individual units, and the flexibility in choosing locations with respect to wind and solar systems.
- Explain the performance of the system when distributed generation is integrated to the system.
- Discuss effects of the integration of DG: the increased risk of overload, increased losses, increased risk of overvoltages and increased levels of power quality disturbances.
- Discuss effects of the integration of DG: incorrect operation of the protection.
- Discuss the impact the integration of DG on power system stability and operation. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Integration of Distributed Generation in the Power System | Math Bollen | Wiley | 2011 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**ADVANCED CONTROL SYSTEMS (Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE734** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To introduce state variable approach for linear time invariant systems in both the continuous and discrete time systems
- To explain development of state models for linear continuous – time and discrete – time systems To explain application of vector and matrix algebra to find the solution of state equations for linear
- continuous – time and discrete – time systems
- To define controllability and observability of a system and testing techniques for controllability and observability of a given system
- To explain design techniques of pole assignment and state observer using state feedback.
- To explain about inherent and intentional nonlinearities that can occur in control system and developing the describing function for the nonlinearities.
- To explain stability analysis of nonlinear systems using describing function analysis.
- To explain the analysis of nonlinear systems using Lyapunov function and design of Lyapunov function for stable systems.

**Module-1**

**State Variable Analysis and Design:** Introduction, Concept of State, State Variables and State Model,StateModelsforLinearContinuous–TimeSystems,StateVariablesandLinearDiscrete– Time Systems.

**Module-2**

**State Variable Analysis and Design (continued):**Diagonalization, Solution of State Equations, Concepts of Controllability and Observability.

**Module-3**

**Pole Placement Design and State Observers:** Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, State Regulator Design, Design of State Observer, Compensator Design by the Separation Principle.

**Module-4**

**Non-linear systems Analysis:** Introduction, Common Nonlinear System Behaviours, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane.

**Module-5**

**Non-linear systems Analysis (continued):**Simple Variable Structure Systems, Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems.

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems.
- Develop of state models for linear continuous–time and discrete–time systems.
- Apply vector and matrix algebra to find the solution of state equations for linear continuous–time and discrete–time systems.
- Define controllability and observability of a system and test for controllability and observability of a given system.
- Design pole assignment and state observer using state feedback.
- Develop the describing function for the nonlinearity present to assess the stability of the system.
- Develop Lyapunov function for the stability analysis of nonlinear systems.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Textbook**

| | | | | |
|---|---|---|---|---|
| 1 | Control Systems Engineering (For the Modules1 and 2) | I.J. Nagarathand M.Gopal | NewAge | 5th Edition,2007 |
| 2 | Digital Control and State Variable Methods: Conventional and Intelligent Control Systems | M.Gopal | McGrawHill | 3rd Edition,2008 |
| 3 | Modern Control Theory | R. V. Parvatikar | Prism Books Pvt. Ltd. | 1 Edition,2014 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **REACTIVE POWER CONTROL IN ELECTRIC POWER SYSTEMS (Professional Elective)** | | | |
| Subject Code | **18EE735** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To identify the necessity of reactive power compensation.
- To describe load compensation.
- To select various types of reactive power compensation in transmission systems.
- To characterize distribution side and utility side reactive power management.
- To contrast reactive power coordination system.

**Module-1**

**Theory of Load Compensation:** Requirement for compensation, Objectives in load compensation, Ideal compensator, Acceptance standards for quality of supply, Specifications of a load compensator, Power factor correction and voltage regulations in single phase system: Power Factor and its Correction, Voltage regulation. T1. Classical load balancing problem: open loop balancing. R1.

**Module-2**

**Theory of Steady State Reactive Power in Uncompensated & Compensated Transmission Line :** Fundamental requirement in AC power transmission, advantages& disadvantages of different types of compensating equipment for transmission systems, fundamental transmission line equation, surge impedance and natural loading, voltage and current profiles of uncompensated line on open circuit, uncompensated line under load, effect of line length, load power and power factor on voltage and reactive power.

**Compensated Transmission Line:** Types of compensation, passive and active compensators,
Uniformly distributed fixed compensation: Effect of distributed compensation on voltage control and effect of distributed compensation on line charging reactive power. T1

**Module-3**

Basics of Capacitors, Reactive Power of Capacitors, Arrangements and Reactive Power of Capacitors, Capacitors Connected in Parallel: Capacitors Connected in Series, Star and Delta Connection of Power Capacitors, Design of MV Capacitors . T2

**Passive shunt compensation:** Control of open circuit voltage with shunt reactors, required reactance values of shunt reactors**.** T1

**Series compensation:** Objectives and practical limitations, Symmetrical line with mid-point series capacitor and shunt reactor, Power transfer characteristics and maximum transmissible power Fundamental concepts of compensation by sectioning. T1

**Module-4**

**Static Compensation:** Practical applications of static compensators in electrical power systems, main types of compensators, principle of operation of Thyristor Controlled Reactor (TCR), Thyristor Controlled Transformer, TCR with shunt capacitors and Thyristor Switched Capacitor (TSC), principle of operation of saturated reactor compensators.

Series Capacitors: compensation factor, protective gear, Varistor protective gear, Resonance effects with series capacitors

Synchronous Condenser: Condenser operation, Power system Voltage control, Emergency reactive power supply, HVDC application.

Comparison of basic types of compensator. T1

**Module-5**

**Harmonics:** Effect of harmonics on electrical equipment, resonance, shunt capacitors and filters, telephone interferences.
**Reactive Power Co-ordination:** Reactive power management, transmission benefits, reactive power dispatch & equipment impact.T1
**Reactive Power Planning:** Economic justification for reactive power planning, methods followed by the electricity boards in India, zonal reactive power requirements EHV & MV, low tension capacitors, placement in distribution, line capacitors. T3

**Course Outcomes:** At the end of the course the student will be able to:

- Distinguish the importance of load compensation in symmetrical as well as unsymmetrical loads.
- Observe various compensation methods in transmission lines.
- Distinguish demand side reactive power management & user side reactive power management.
- Construct model for reactive power coordination and effects of harmonics on electrical equipments.
- Discuss the Reactive Power Planning for the electricity boards.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Reactive power control in electric power systems | T. J. E. Miller | John Wiley & Sons NY | 2009 |
| 2 | Reactive Power Compensation : A Practical Guide | Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just. | John Wiley | 2012 |
| 3 | Reactive Power Management | D. Tagare | TMH | 1st Edition,2004 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Power Quality Enhancement Using Custom Power Devices | Arindam Ghosh, Gerard Ledwich | Kluwer International Series | 2002 |
| 2 | Power System Voltage Stability | Carson. W. Taylor, | McGraw-Hill, Inc. | 1993 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**INDUSTRIAL DRIVES AND APPLICATIONS (Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE741** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To define electric drive, its parts, advantages and explain choice of electric drive.
- To explain dynamics and modes of operation of electric drives.
- To explain selection of motor power ratings and control of DC motor using rectifiers.
- To analyze the performance of induction motor drives under different conditions.
- To explain the control of induction motor, synchronous motor and stepper motor drives.
- To discuss typical applications electrical drives in the industry. ■

**Module-1**

**Electrical Drives:** Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of DC and ac Drives.
**Dynamics of Electrical Drives:** Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization.
**Control Electrical Drives:** Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. ■

**Module-2**

**Direct Current Motor Drives:** Controlled Rectifier Fed DC Drives, Single Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Single Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Multiquadrant Operation of DC Separately Excited Motor Fed Form Fully Controlled Rectifier, Rectifier Control of DC Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited DC Motor, Chopper Control of Series Motor. ■

**Module-3**

**Induction Motor Drives:** Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques-Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. ■

**Module-4**

**Induction Motor Drives (continued):** Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors.

**Synchronous Motor Drives:** Operation from fixed frequency supply-starting, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. ■

**Module-5**

**Synchronous Motor Drives (continued):** Self-controlled synchronous motor drive employing load commutated thyristor inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives.
**Stepper Motor Drives**: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor.
**Industrial Drives:** Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain the advantages, choice and control of electric drive
- Explain the dynamics, generating and motoring modes of operation of electric drives
- Explain the selection of motor power rating to suit industry requirements
- Analyze the performance & control of DC motor drives using controlled rectifiers
- Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Fundamentals of Electrical Drives | Gopal K. Dubey | Narosa Publishing | 2nd Edition, 2001 |
| 2 | Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives | VedumSubrahmanyam | McGraw Hill | 2nd Edition, 2011 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Electric Drives | N.K De,P.K. Sen | PHI Learning | 1st Edition, 2009 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VII | | | |
|---|---|---|---|
| **UTILIZATION OF ELECTRICAL POWER(Professional Elective)** | | | |
| Course Code | **18EE742** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss electric heating, air-conditioning and electric welding.
- To explain laws of electrolysis, extraction and refining of metals and electro deposition.
- To explain the terminology of illumination, laws of illumination, construction and working of electric lamps.
- To explain design of interior and exterior lighting systems- illumination levels for various purposes light fittings- factory lighting- flood lighting-street lighting
- To discuss systems of electric traction, speed time curves and mechanics of train movement.
- To discuss motors used for electric traction and their control.
- To discuss braking of electric motors, traction systems and power supply and other traction systems.
- Give awareness of technology of electric and hybrid electric vehicles. ■

**Module-1**

**Heating and welding:** Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques.

**Electrolytic Electro – Metallurgical Process:**Ionization, Faraday's Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, Electro Deposition. ■

**Module-2**

**Illumination:** Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting. ■

**Module-3**

**Electric Traction Speed - Time Curves and Mechanics of Train Movement:** Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement,Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion.

**Motors for Electric traction:**Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor.

**Control of motors:** Control of DC Motors,Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors. ■

**Module-4**

**Braking:** Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes.

**Electric Traction Systems and Power Supply:** System of Electric Traction, AC Electrification Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC Traction Feeding and Distribution System for DC Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires.

**Trams, Trolley Buses and Diesel – Electric Traction:** Tramways, The Trolley – Bus, Diesel Electric Traction. ■

**Module-5**

**Electric Vehicles:** Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption.

**Hybrid Electric Vehicles:** Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss different methods of electric heating & welding.
- Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process.
- Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
- Analyze systems of electric traction, speed time curves and mechanics of train movement.
- Explain the motors used for electric traction, their control & braking and power supply system used for electric traction.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | A Text Book on Power System Engineering | A. Chakrabarti et al | DhanpatRai and Co | 2nd Edition, 2010 |
| 2 | Modern Electric,Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters 04 and 05 for module 5) | Mehrdad Ehsani et al | CRC Press | 1stEdition, 2005 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Utilization, Generation and Conservation of Electrical Energy | Sunil S Rao | Khanna Publishers | 1stEdition, 2011 |
| 2 | Utilization of Electric Power and Electric Traction | G.C. Garg | Khanna Publishers | 9thEdition, 2014 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**PLC and SCADA(Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE743** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3L | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-in Circuits and Latching Relays.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes.
- To understand SCADA and how it deals with the control and data acquisition from systems
- To understand what RTU does, how it does and what. ■

**Module-1**

**Programmable Logic Controllers:** Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

**PLC Hardware Components:** The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

**Basics of PLC Programming:** Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of operation■

**Module-2**

**Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs:** Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

**Programming Timers:** Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.■

**Module-3**

**Programming Counters:** Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

**Program Control Instructions:** Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■

**Module-4**

**SCADA Fundamentals:** Introduction, Open system: Need and advantages, Building blocks of SCADA systems, Remote terminal unit (RTU): Evolution of RTUs, Components of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs), Data concentrators and merging units, SCADA communication systems,

**Master Station**: Master station software components, Master station hardware components, Server systems in the master station, Small, medium, and large master stations, Global positioning systems (GPS), Master station performance. ■

**Module-5**

**Human-Machine Interface (HMI):**HMI components, HMI software functionalities, Situational awareness, Intelligent alarm filtering: Need and technique, Alarm suppression techniques, Operator needs and requirements,

**SCADA Systems:** Building the SCADA systems, legacy, hybrid, and new systems, Classification of SCADA systems, SCADA implementation: A laboratory model: The SCADA laboratory, System hardware, System software, SCADA lab field design. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions.
- Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Convert relay schematics and narrative descriptions into PLC ladder logic programs.
- Analyse PLC timer and counter ladder logic programs.
- Understand about SCADA systems and its subsystems. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Programmable Logic Controllers | Frank D Petruzella | McGraw Hill | 4th Edition, 2011 |
| 2 | Power System SCADA and Smart Grids | Mini S. Thomas | CRC Press | 3rd Edition,2015 |

**Reference Book**

| | | | | |
|---|---|---|---|---|
| 1 | Programmable Logic Controllers an Engineer's Guide | E A Parr | Newnes | 3rd Edition, 2013 |
| 2 | Introduction Programmable Logic Controllers | Gary Dunning | Cengage | 3rd Edition, 2006 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**SMART GRID ( Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE744** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3L | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To understand the basic concept of smart grid, attributes of Smart Grid
- To describe the over view of the perfect power system configuration
- To know about DC power delivering systems ,data centers and information technology loads
- To educate the importance of Technology Alternatives in smart Grid
- To understand the Dynamic energy systems in Smart Grid
- To describe the overview of Demand side planning and evaluation

**Module-1**

**Introduction:** Introduction to smart grid, electricity network, local energy networks, electric transportation, low carbon central generation, attributes of the smart grid.

**Smart Grid to Evolve a Perfect Power System**: Introduction, overview of the perfect power system configurations, device level power system, building integrated power systems, distributed power systems, fully integrated power system.■

**Module-2**

**DC Distribution and Smart Grid:** AC Vs. DC sources, benefits of and drives of DC power delivery systems, powering equipment and appliances with DC, data centers and information technology loads, potential future work and research

**Intelligrid Architecture for the Smart Grid:** Introduction, launching intelligrid, intelligrid today, smart grid vision based on the intelligrid architecture.■

**Module-3**

**Dynamic Energy Systems Concept:** Smart energy efficient end use devices, smart distributed energy resources, advanced whole building control systems, integrated communications architecture, energy management, role of technology in demand response, current limitations to dynamic energy management, distributed energy resources, overview of a dynamic energy management, key characteristics of smart devices, key characteristics of advanced whole building control systems, key characteristics of dynamic energy management system.■

**Module-4**

**Efficient Electric End Use Technology Alternatives:** Existing technologies ,lighting, space conditioning, indoor air quality, domestic water heating, hyper efficient appliances, ductless residential heat pumps and air conditioners, variable refrigerant flow air conditioning, heat pump water heating, hyper efficient residential appliances, data center energy efficiency, LED street and area lighting, industrial motors and drives, equipment retrofit and replacement, process heating, cogeneration, thermal energy storage, industrial energy management programs, manufacturing process, electro -technologies, residential, commercial and industrial sectors.■

**Module-5**

**Demand side planning:** Introduction, Selecting Alternatives, Issues Critical to the Demand-side Issues Critical to the Demand-side, The Utility Planning Process, Demand-side Activities, Alternatives that Are Most Beneficial.

**Demand-Side Evaluation:** Levels of Analysis. General Information Requirements .System, Context, Transferability, Data Requirement, Cost/Benefit Analysis, Program Interaction.■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain the concept of Smart grid enables the ElectricNet and need of smart grid.
- Outline the benefits and drivers of DC Power delivery system.
- Summarize the Intelligrid Architecture for the smart grid.
- Explain the Efficient Electric End-use Technology Alternatives.
- Discuss Demand side planning and Evaluation.■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

Students will have to answer 5 full questions, selecting one full question from each module.■

**Textbook**

| | | | | |
|---|---|---|---|---|
| 1 | The Smart Grid, Enabling Energy Efficiency and Demand Side Response | Clark W Gellings | CRC Press, 2009. | 3rd Edition, 2013. |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Smart Grid :Technology and Applications | Janaka Ekanayake, Kithsiri Liyanage,Jianzhong | Wiley | 2012 |
| 2 | Fundamentals of Design and Analysis | James Momoh | Wiley, IEEE Press, | 2012 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**ARTIFICIAL NEURAL NETWORK WITH APPLICATIONS TO POWER SYSTEMS**
**(Professional Elective)**

| | | | |
|---|---|---|---|
| Subject Code | **18EE745** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| Credits | 4 | Exam Hours | 03 |

**Course Learning Objectives:**

- To understand the fundamental concepts and models of Artificial Neural Systems.
- To understand neural processing, learning and adaptation, Neural Network learning rules.
- Ability to analyze multilayer feed forward networks.
- Ability to develop various ancillary techniques applied to power system and control of power systems.

**Module-1**

**Fundamental Concepts and Models of Artificial Neural Systems**

Biological Neurons and their artificial models – Biological Neuron, McCulloch-Pitts Neuron Model, Neuron modeling for Artificial neural systems. Models for Artificial Neural Networks – Feedforward Network, Feedback network. ■

**Module-2**

**Neural Processing, Learning and Adaptation, Neural Network Learning Rules**

Neural Processing. Learning and Adaptation – Learning as Approximation or Equilibria Encoding, Supervised and Unsupervised Learning. Neural Network Learning Rules – Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Correlation Learning Rule, Winner-Take-All Learning Rule, Outstar Learning Rule, Summary of Learning Rules. ■

**Module-3**

**Multilayer Feedforward Networks**

Feedforward Recall and Error Back-Propagation Training – Feedforward Recall, Error Back-Propagation Training, Training Errors and Multilayer Feedforward Networks as Universal Approximators (Excluding Examples). Learning Factors – Initial Weights, Cumulative Weight Adjustment versus Incremental Updating, Steepness of the Activation Function, Learning Constant, Momentum Method, Network Architectures Versus Data Representation, Necessary Number of Hidden Neurons. ■

**Module-4**

**Neural Network and its Ancillary Techniques as Applied to Power Systems**

Introduction, Learning versus Memorization, Determining the Best Net Size, Network Saturation, Feature Extraction, Inversion of Neural Networks, Alternative Training Method: Genetic Based Neural Network, Fuzzified Neural Network. ■

**Module – 5**

**Control of Power Systems**

Introduction, Background, Neural Network Architectures for modeling and control, Supervised Neural Network Structures, Diagonal Recurrent Neural Network based Control System, Convergence and Stability. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Develop Neural Network and apply elementary information processing tasks that neural network can solve.
- Develop Neural Network and apply powerful, useful learning techniques.
- Develop and Analyze multilayer feed forward network for mapping provided through the first network layer and error back propagation algorithm.
- Analyze and apply algorithmic type problems to tackle problems for which algorithms are not available.
- Develop and Analyze supervised/unsupervised, learning modes of Neural Network for different applications. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Introduction to Artificial Neural Systems. | Jacek M. Zurada | JAICO Publishing House | 2006 |
| 2 | Artificial Neural Networks with Applications to Power Systems | Edited by – Mohamed El – Sharkawi and Dagmar Niebur | IEEE, Inc. | 1996 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**POWER SYSTEM SIMULATION LABORATORY**

| | | | |
|---|---|---|---|
| Course Code | **18EEL76** | CIE Marks | 40 |
| Number of Practical Hours/Week(L:T:P) | 0:2:2 | SEE Marks | 60 |
| **Credits** | 02 | Exam Hours | 03 |

**Course Learning Objectives:**

To explain the use of standard software package:
(Ex: MATLAB/C or C ++/Scilab/ Octave/Python software)

- To assess the performance of medium and long transmission lines.
- To obtain the power angle characteristics of salient and non- salient pole alternator.
- To study transient stability of radial power systems under three phase fault conditions.
- To develop admittance and impedance matrices of interconnected power systems.
- To explain the use of suitable standard software package.
- To solve power flow problem for simple power systems.
- To perform fault studies for simple radial power systems.
- To study optimal generation scheduling problems for thermal power plants.

| **Sl. No.** | | **Experiments** |
|---|---|---|
| 1 | **Use of Standard Simulation Software Package** | Formation for symmetric $\pi$ /T configuration for Verification of Determination of Efficiency and Regulation. |
| 2 | | Determination of Power Angle Diagrams, Reluctance Power, Excitation, EMF and Regulation for Salient and Non-Salient Pole Synchronous Machines. |
| 3 | | To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines. |
| 4 | | Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular |
| 5 | | Formation of Z Bus(without mutual coupling) using Z-Bus Building Algorithm. |
| 6 | | Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage |
| 7 | | Formation of Jacobian for a System not Exceeding 4 Buses in Polar Coordinates. |
| 8 | | Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses. |
| 9 | | To Determine Fault Currents and Voltages in a Single Transmission Line System with |
| 10 | | Optimal Generation Scheduling for Thermal power plants by simulation. |

**Course Outcomes:** At the end of the course the student will be able to:

- Develop a program in suitable package to assess the performance of medium and long transmission lines.
- Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator.
- Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
- Develop programs in suitable package to formulate bus admittance and bus impedance matrices of interconnected power systems.
- Use suitable package to solve power flow problem for simple power systems.
- Use suitable package to study unsymmetrical faults at different locations in radial power systems
- Use of suitable package to study optimal generation scheduling problems for thermal power plants.

**Conduct of Practical Examination:**

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**RELAY AND HIGH VOLTAGE LABORATORY**

| | | | |
|---|---|---|---|
| Course Code | **18EEL77** | CIE Marks | 40 |
| Number of Practical Hours/Week | 0:2:2 | SEE Marks | 60 |
| Credits | 02 | Exam Hours | 03 |

**Course Learning Objectives:**

- To conduct experiments to verify the characteristics of over current, over voltage, under voltage relays both electromagnetic and static type.
- To verify the operation of negative sequence relay.
- To conduct experiments to verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
- To conduct experiments on generator, motor and feeder protection.
- To conduct experiments to study the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages.
- To measure high AC and DC voltages
- To experimentally measure the breakdown strength of transformer oil**.**
- To experimentally measure the capacitance of different electrode configuration models using
- Electrolytic Tank. To generate standard lightning impulse voltage and determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■

| Sl. NO | | Experiments |
|---|---|---|
| **Total of Six experiments are to be conducted by selecting Two experiments from each Part – A, Part – B and Part – C. Five out of six experiments are to be conducted under Part – D.** | | |
| 1 | **Part - A** | Over Current Relay: (a)Inverse Definite Minimum Time(IDMT)Non-Directional Characteristics (b) Directional Features (c) IDMT Directional. |
| 2 | | IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type). |
| 3 | | Operation of Negative Sequence Relay. |
| 4 | **Part - B** | Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay. |
| 5 | | Operating Characteristics of Microprocessor Based (Numeric) Distance Relay. |
| 6 | | Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage |
| 7 | **Part - C** | Generation Protection: Merz Price Scheme. |
| 8 | | Feeder Protection against Faults. |
| 9 | | Motor Protection against Faults. |
| 10 | **Part - D** | Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS1876: 2005]and Non-uniform [as per IS2071(Part 1) : 1993] Configurations: Sphere – Sphere, Point –Plane, |
| 11 | | Spark Over Characteristics of Air subjected to High voltage DC. |
| 12 | | Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005 |
| 13 | | Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005 |
| 14 | | Field Mapping using Electrolytic Tank for any one of the following Models: Cable/ Capacitor/ |
| 15 | | (a) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage. |

| |
|---|
| **Course Outcomes:** At the end of the course the student will be able to:<br>• Verify the characteristics of over current, over voltage, under voltage and negative sequence relay both electromagnetic and static type.<br>• Verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.<br>• Show knowledge of protecting generator, motor and feeders.<br>• Analyze the spark over characteristics for both uniform and non-uniform configurations using High A and DC voltages.<br>• Measure high AC and DC voltages and breakdown strength of transformer oil.<br>• Draw electric field and measure the capacitance of different electrode configuration models.<br>• Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■ |
| **Conduct of Practical Examination:**<br>1. All laboratory experiments are to be included for practical examination.<br>2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.<br>3. Students can pick one experiment from the questions lot prepared by the examiners.<br>4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ |
| |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

**PROJECT PHASE – I**

| | | | |
|---|---|---|---|
| Course Code | **18EEP78** | CIE Marks | 100 |
| Number of Practical Hours/Week | 0:0:2 | Exam Hours | -- |
| **Credits** | 1 | Exam Marks | -- |

**Course Learning Objectives:**

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organization, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgment, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

**Project Phase-1** Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work

**Course Outcomes:** At the end of the course the student will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation and solution.
- Design engineering solutions to complex problems utilizing a systems approach.
- Communicate with engineers and the community at large in written an oral forms.

**Continuous Internal Evaluation**

CIE marks for the project phase I 100 marks.

i. Report 50 marks
ii. Partial result and presentation 50 marks

Marks shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.

## VIII SEMESTER DETAILED SYLLABUS

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VIII**

**POWER SYSTEM OPERATION AND CONTROL(Core Course)**

| | | | |
|---|---|---|---|
| Course Code | **18EE81** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To describe various levels of controls in power systems and the vulnerability of the system.
- To explain components, architecture and configuration of SCADA.
- To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control
- To explain automatic generation control, voltage and reactive power control in an interconnected power system.
- To explain reliability and contingency analysis, state estimation and related issues.

**Module-1**

**Introduction:** Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centers. R1

**Supervisory Control and Data acquisition (SCADA):** Introduction, components, application in Power System, basic functions and advantages. Building blocks of SCADA system, components of RTU, communication subsystem, IED functional block diagram. R2

**Classification of SCADA system:** Single master–single remote; Single master–multiple RTU; Multiple master–multiple RTUs; and Single master, multiple submaster, multiple remote. R2

**Module-2**

**Automatic Generation Control (AGC):** Introduction, Schematic diagram of load frequency and excitation voltage regulators of turbo generators, Load frequency control (Single area case), Turbine speed governing system, Model of speed governing system, Turbine model, Generator load model, Complete block diagram of representation of load frequency control of an isolated power system, Steady state analysis, Control area concept, Proportional plus Integral Controller. T1

**Module-3**

**Automatic Generation Control in Interconnected Power system:** Two area load frequency control, Optimal (Two area) load frequency control by state variable, Automatic voltage control, Load frequency control with generation rate constraints (GRCs), Speed governor dead band and its effect on AGC, Digital LF Controllers, Decentralized control. T1

**Module-4**

**Control of Voltage and Reactive Power:** Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Methods of voltage control: i. Injection of reactive power, Shunt capacitors and reactors, Series capacitors, Synchronous compensators, Series injection. ii Tap changing transformers. Combined use of tap changing transformers and reactive power injection, Booster transformers, Phase shift transformers, Voltage collapse. T3

**Module-5**

**Power System Security:** Introduction, Factors affecting power system security, Contingency Analysis, Linear Sensitivity Factors, AC power flow methods, Contingency Selection and Ranking. T2

**State estimation of Power Systems:** Introduction, Linear Least Square Estimation. T2

**Course Outcomes:** At the end of the course the student will be able to:

- Describe various levels of controls in power systems, architecture and configuration of SCADA.
- Develop and analyze mathematical models of Automatic Load Frequency Control.
- Develop mathematical model of Automatic Generation Control in Interconnected Power system
- Discuss the Control of Voltage , Reactive Power and Voltage collapse.
- Explain security, contingency analysis, state estimation of power systems.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Modern Power System Analysis | D. P. Kothari | McGraw Hill | 4th Edition, 2011 |
| 2 | Power Generation Operation and Control | Allen J Wood etal | Wiley | 2nd Edition,2003 |
| 3 | Electric Power Systems | B M Weedy, B J C | Wiley | 4th Edition, 2012 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Computer-Aided Power System Analysis | G. L. Kusic | CRC Press | 2nd Edition.2010 |
| 2 | Power System SCADA and Smart Grid | Mini S Thom and John D. McDonald | CRC Press | 2015 |
| 3 | Power System Stability and Control | Kundur | McGraw Hill | 8th Reprint, 2009 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VIII**

**FACTS AND HVDC TRANSMISSION ( Professional Elective )**

| | | | |
|---|---|---|---|
| Course Code | **18EE821** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| **Credits** | 3 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.
- To explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.
- To describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
- To describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
- To explain advantages of HVDC power transmission, overview and organization of HVDC system.
- To describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
- Explain converter control for HVDC systems, commutation failure, control functions.■

**Module-1**

**FACTS Concept and General System Considerations:** Transmission Interconnections, Flow of Power in an AC System, What Limits the Loading Capability? Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers, Checklist of Possible Benefits from FACTS Technology, In Perspective: HVDC or FACTS.■

**Module-2**

**Static Shunt Compensators:** Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability. Methods of Controllable Var Generation –Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC).Operation of Single Phase TSC – TSR. Switching Converter Type Var Generators, Basic Operating Principles, Basic Control Approaches. Static VAR Compensators: SVC and STATCOM, the Regulation Slope. Comparison between STATCOM and SVC, V –I and V –Q Characteristics, Transient stability, Response Time.■

**Module-3**

**Static Series Compensators:** Objectives of Series Compensation, Concept of Series Capacitive Compensation, Voltage Stability, Improvement of Transient Stability. GTO Thyristor-Controlled Series Capacitor, Thyristor-Switched Series Capacitor, Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator, Transmitted Power Versus Transmission AngleCharacteristic.■

**Module-4**

**Development of HVDC Technology:**Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, HVDC Characteristics and Economic Aspects.

**Power Conversion:**3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter.■

| **Module-5** |
|---|
| **Control of HVDC Converter and System:** Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design, HVDC Control Functions, Reactive Power and Voltage Stability. |
| **Course Outcomes:** At the end of the course the student will be able to:<br>• Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.<br>• Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.<br>• Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.<br>• Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.<br>• Explain advantages of HVDC power transmission, overview and organization of HVDC system.<br>• Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.<br>• Explain converter control for HVDC systems, commutation failure, control |
| Question paper pattern:<br>• The question paper will have ten questions.<br>• Each full question is for 20 marks.<br>• There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.<br>• Each full question with sub questions will cover the contents under a module.<br>• Students will have to answer 5 full questions, selecting one full question from each module. |

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems | Narain G Hingorani, Laszlo Gyugyi | Wiley | 1st Edition, 2000 |
| 2 | HVDC Transmission: Power Conversion Applicationsin Power Systems | Chan-Ki Kim et al | Wiley | 1st Edition, 2009 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Thyristor Based FACTS Controllers for Electrical Transmission Systems | R. Mohan Mathur, Rajiv K. Varma | Wiley | 1st Edition, 2002 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VIII**

**ELECTRICAL ESTMATION AND COSTING (Professional Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE822** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss the purpose of estimation and costing.
- To discuss market survey, estimates, purchase enquiries, tenders, comparative statement and payment of bills and Indian electricity act and some of the rules.
- To discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories, fittings and fuses.
- To discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
- To discuss different types of service mains and estimation of power circuits.
- To discuss estimation of overhead transmission and distribution system and its components.
- To discuss main components of a substation, their graphical representation and preparation of single line diagram of a substation. ■

**Module-1**

**Principles of Estimation:** Introduction to Estimation and Costing, Electrical Schedule, Catalogues, Market Survey and Source Selection, Recording of Estimates, Determination of Required Quantity of Material, Labour Conditions, Determination of Cost Material and Labour, Contingencies, Overhead Charges, Profit, Purchase System, Purchase Enquiry and Selection of Appropriate Purchase Mode, Comparative Statement, Purchase Orders, Payment Of Bills, Tender Form, General Idea about IE Rule, Indian Electricity(IE) Act and IE Rules -29,30,45,46,47,50,51,54,55,77 and79. ■

**Module-2**

**Wiring:** Introduction, Distribution of energy in a Building, PVC Casing and Capping, Conduit Wiring, Desirabilities of Wiring. Types of cables used in Internal Wiring, Multi Strand Cables, Voltage Grading and Specification of Cables

**Wiring (continued):** Main Switch and Distribution Board, Conduits and its accessories and Fittings. Lighting Accessories and Fittings, Types of Fuses, Size of Fuse, Fuse Units, Earthing Conductor. **Internal Wiring:** General rules for wiring, Design of Lighting Points (Refer to Seventh Chapter of the Text Book), Number of Points, Determination of Total Load, Number of Sub –Circuits, Ratings Main Switch and Distribution Board and Size of Conductor. Current Density, Layout. ■

**Module-3**

**Service Mains:** Introduction, Types, Estimation of Underground and Overhead Service Connections.
**Design and Estimation of Power Circuits:** Introduction, Important Considerations Regarding Motor Installation Wiring, Input Power, Input Current to Motors, Rating of Cables, Rating of Fuse, Size of Condit, Distribution Board Main Switch and Starter. ■

**Module-4**

**Estimation of Overhead Transmission and Distribution Lines:** (Review of Line Supports, Conductor Materials, Size of Conductor for Overhead Transmission Line, Types of Insulators)[No Question Shall be Set From the Review Portion].
Cross Arms, Pole Brackets and Clamps, Guys and Stays, Conductors Configuration Spacing and Clearances, Span Lengths, Lightning Arrestors, Phase Plates, Danger Plates, Anti Climbing Devices, Bird Guards, Beads of Jumpers, Muffs, Points to be Considered at the Time of Erection of Overhead Lines, Erection of Supports, Setting of Stays, Fixing of Cross Arms, Fixing of Insulators, Conductor Erection. ■

**Module-4 (continued)**

**Estimation of Overhead Transmission and Distribution Lines (continued):** Repairing and Jointing of Conductors, Dead End Clamps, Positioning of Conductors and Attachment to Insulator s, Jumpers, Tee-Offs, Earthing of Transmission Lines, Guarding of Overhead Lines, Clearances of Conductor From Ground, Spacing Between Conductors, Important Specifications. ■

**Module-5**

**Estimation of Substations:** Main Electrical connection, Graphical Symbols for Various Types of Apparatus and Circuit Elements on Substation main Connection Diagram, Single Line Diagram of Typical Substations, Equipment for Substation, Substation Auxiliaries Supply, Substation Earthing. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain general principles of estimation and major applicable I.E. rules.
- Discuss wiring methods, cables used, design of lighting points and sub-circuits, internal wiring, wiring accessories and fittings, fuses and types.
- Discuss estimation of service mains and power circuits.
- Discuss estimation of overhead transmission and distribution system its components.
- Discuss types of substation, main components and estimation of substation.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | A Course in Electrical Installation Estimating and Costing | J. B. Gupta | Katson Books, | 9th Edition, 2012 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VIII**

**ELECTRIC VEHICLE TECHNOLOGIES (Professional Elective)**

| | | | |
|---|---|---|---|
| Subject Code | **18EE823** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**
- To understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles.
- Ability to design converters for battery charging and explain transformer less topology.

**Module-1**

**Electric and Hybrid Electric Vehicles**
Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. ■

**Module-2**

**Energy storage for EV and HEV**
Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors. ■

**Module-3**

**Electric Propulsion**
EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. ■

**Module – 4**

**Design of Electric and Hybrid Electric Vehicles**
Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design. ■

**Module – 5**

**Power Electronic Converter for Battery Charging**
Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z- converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology. ■

**Course Outcomes:** At the end of the course the student will be able to:
- Explain the working of electric vehicles and recent trends.
- Analyze different power converter topology used for electric vehicle application.
- Develop the electric propulsion unit and its control for application of electric vehicles.
- Design converters for battery charging and explain transformer less topology. ■

**Question paper pattern:**
- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design | M. Ehsani, Y. Gao, S. Gay and Ali Emadi | CRC Press | 2005 |
| 2 | Electric and Hybrid Vehicles: Design Fundamentals | Iqbal Husain | CRC Press | 2003 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles | Sheldon S. Williamson | Springer | 2013 |
| 2 | Modern Electric Vehicle Technology | C.C. Chan and K.T. Chau | OXFORD University | 2001 |
| 3 | Hybrid Electric Vehicles Principles And Applications With Practical Perspectives | Chris Mi, M. Abul Masrur, David Wenzhong Gao | Wiley Publication | 2011 |
| | | | | |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)**
**CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)**

**POWER SYSTEM PLANNING (Professional Elective)**

| | | | |
|---|---|---|---|
| Subject Code | **18EE824** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss primary components of power system planning namely load furcating, evaluation of energy resources, provisions of electricity Act and Energy Conservation Act.
- To explain planning methodology for optimum power system expansion, various types of generation, transmission and distribution
- To explain forecasting of anticipated future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.
- To discuss methods to mobilize resources to meet the investment requirement for the power sector
- To perform economic appraisal to allocate the resources efficiently and take proper investment decisions
- To discuss expansion of power generation and planning for system energy in the country
- To discuss evaluation of operating states of transmission system, their associated contingencies and determination of the stability of the system for worst case conditions
- To discuss principles of distribution planning, supply rules, network development and the system studies
- To discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis.
- To discuss grid reliability, voltage disturbances and their remedies.
- To discuss planning and implementation of electric –utility activities designed to influence consumer uses of electricity.
- To discuss market principles and the norms framed by CERC for online trading and exchange in the interstate power market. ■

**Module-1**

**Power System:** Planning Principles, Planning Process, Project Planning, Power Development, National and Regional Planning, Enterprise Resources Planning, Planning Tools, Power Planning Organisation, Scenario Planning.

**Electricity Forecasting:** Load Requirement, System Load, Electricity Forecasting, Forecasting Techniques, Forecasting Modelling, Spatial – Load Forecasting, Peak Load - Forecast, Reactive – Load Forecast, Unloading of a System.■

**Module-2**

**Power-System Economics:** Financial Planning, Techno – Economic Viability, Private Participation, Financial Analysis, Economic Analysis, Transmission, Rural Electrification Investment, Total System Analysis, Credit - Risk Assessment.

**Generation Expansion:** Generation Capacity and Energy, Generation Mix, Clean Coal Technologies Renovation and Modernisation of Power Plants. ■

**Module-3**

**Transmission Planning:** Transmission Planning Criteria, Right – of – Way, Network Studies, High – Voltage Transmission, HVDC Transmission, Conductors, Sub – Stations, Power Grid, Reactive Power Planning, Energy Storage.■

**Module-4**

**Distribution:** Distribution Deregulation, Planning Principles, Electricity – Supply Rules, Criteria and Standards, Sub – Transmission, Basic Network, Low Voltage Direct Current Electricity,

**Module-4 (continued)**

**Distribution(continued):** Upgradation of Existing Lines and Sub – Stations, Network Development, System Studies, Urban Distribution, Rural Electrification.

**Reliability and Quality:** Reliability Models, System Reliability, Reliability and Quality Planning, Functional Zones, Generation Reliability Planning Criteria, Transmission Reliability Criteria, Distribution Reliability, Reliability Evaluation, Grid Reliability, Quality of Supply. ■

**Module-5**

**Demand-Side Planning:** Demand Response, Demand – Response Programmes, Demand– Response Technologies, Energy Efficiency, Energy - Economical Products, Efficient – Energy Users, Supply – Side Efficiency, Energy Audit.

**Electricity Market:** Market Principles, Power Pool, Independent System Operator, Distribution System Operator, Power Markets, Market Rules, Bidding, Trading, Settlement System, Merchant Power, Differential Electricity, Congestion Management, Ancillary Services, Hedging, Smart Power Market. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting.
- Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions
- Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.
- Discuss principles of distribution planning, supply rules, network development and the system studies
- Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies
- Discuss planning and implementation of electric –utility activities, market principles and the norms framed. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Textbook**

| | | | | |
|---|---|---|---|---|
| 1 | Electric Power Planning | A. S. Pabla | McGraw Hill, | 2nd Edition, 2016 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **ELECTRICAL POWER QUALITY (Professional Elective)** | | | |
| Course Code | **18EE825** | CIE Marks | 40 |
| Number of Lecture Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- Review definitions and standards of common power quality phenomena.
- Understand power quality monitoring and classification techniques.
- Investigate different power quality phenomena causes and effects.
- Understand different techniques for power quality problems mitigation.
- Understand the various power quality phenomenon, their origin and monitoring and mitigation methods.
- Understand the effects of various power quality phenomenon in various equipment's

**Module-1**

**Introduction:** Power quality-voltage quality, power quality evaluation procedures term and definitions: general classes of power quality problems, transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion, power quality terms. ■

**Module-2**

**Voltage sags and interruptions:** Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, motor starting sags.

**Transient over voltages:** Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients. ■

**Module-3**

**Transient over voltages:** Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion, intra harmonics. ■

**Module-4**

**Applied harmonics:** Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics. ■

**POWER QUALITY BENCHMARK:** Introduction, benchmark process, power quality contract.

**Module-5**

**Power quality benchmark:** power quality state estimation, including power quality in distribution planning.

**Distributed generation and quality**: DG technologies, interface to utility system, power quality issues, interconnection standards. ■

**Course Outcome:** At the end of the course the student will be able to:

- Define Power quality; evaluate power quality procedures and standards.
- Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.
- Identify various sources of harmonics, explain effects of harmonic distortion.
- Evaluate harmonic distortion, control harmonic distortion.
- Estimate power quality in distribution planning. Identify power quality issues in utility system. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1. | Electric Power Quality | Dugan, Roger C, Mark F | McGraw-Hill professional | 2003. |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1. | Electric Power Quality | G.T.Heydt | Stars in a circle publications | 1991. |

| | | | | |
|---|---|---|---|---|
| 2. | Understanding power quality problems voltage sags and interruptions | Math H. J. Bollen. | IEEE Press | 2000 |
| 3. | Power quality in power systems and electrical machines | Ewald F Fuchs, Mohammad, A.S., Masoum | Academic Press, Elsevier | 2009 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VII / VIII | | | |
|---|---|---|---|
| **INTERNSHIP** | | | |
| Course Code | **18EEI85** | CIE Marks | 40 |
| Number of Practical Hours/Week | -- | SEE Marks | 60 |
| **Credits** | **03** | Exam Hours | 03 |

**Course Learning Objectives:**
Internship provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public. ■

**Internship:** Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

**Seminar:** Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills. ■

**Continuous Internal Evaluation**

CIE marks : 40 Marks

i. Successful completion of Internship training in an organization and certification from competitive authority-20 marks
ii. Presentation and report -20 Marks

(based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■

**Semester End Examination**

SEE marks – 60 Marks based on presentation skill, participation in the question and answer session by the student to the examiners appointed by the University. ■

## Open Electives A/B

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER – VI | | | |
|---|---|---|---|
| **INDUSTRIAL SERVO CONTROL SYSTEMS(Open Elective)** | | | |
| Course Code | **18EE651** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
- To discuss system analogs and vectors, with a review of differential equations.
- To discuss the concept of transfer functions for the representation of differential equations.
- To discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
- To represent servo drive components by their transfer function, to combine the servo drive building blocks into system block diagrams.
- To determine the frequency response techniques for proper servo compensation. ■

**Module-1**

**Servos:** Introduction, Benefits of Servo Systems, Types of Servos - Evolution of Servo Drives, Classification of Drives, Components of Servos - Hydraulic/Electric Circuit Equations, Actuators—Electric,Actuators—Hydraulic,Amplifiers—Electric,Amplifiers—Hydraulic,Transducers (Feedback). ■

**Module-2**

**Machine Servo Drives:** Types of Drives, Feed Drive Performance.
**Troubleshooting Techniques:** Techniques by Drive, Problems: Their Causes and Cures.
**Machine Feed Drives:** Advances in Technology, Parameters for making Application Choices.
**Application of Industrial Servo Drives:** Introduction ,Physical System Analogs, Quantities and Vectors, Differential Equations for Physical Systems, Electric Servo Motor Transfer Functions and Time Constants, Transport Lag Transfer Function, Hydraulic Servo Motor Characteristics, General Transfer Characteristics. ■

**Module-3**

**Generalized Control Theory:** Servo Block Diagrams, Frequency-Response Characteristics and Construction of Approximate (Bode) Frequency Charts, Nichols Charts, Servo Analysis Techniques, Servo Compensation.
**Indexes of Performance:** Definition of Indexes of Performance for Servo Drives, Indexes of Performance for Electric and Hydraulic Drives. ■

**Module-4**

**Performance Criteria:** Percent Regulation, Servo System Responses.
**Ser Plant Compensation Techniques:** Dead-Zone Nonlinearity, Change-in-Gain Nonlinearity, Structural Resonances, Frequency Selective Feedback, Feed forward Control.
**Machine Considerations:** Machine feed drive Considerations, Ball Screw Mechanical Resonances and Reflected Inertias for Machine Drives. ■

**Module-5**

**Machine Considerations:** Drive Stiffness, Drive Resolution, Drive Acceleration, Drive Speed Considerations, Drive Ratio Considerations, Drive Thrust/Torque And Friction Considerations, Drive Duty Cycles. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
- Discuss system analogs, vectors and transfer functions of differential equations.
- Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
- Represent servo drive components by their transfer function, to combine the servo drive buildingblocks into system block diagrams.
- Determine the frequency response techniques for proper servo compensation.
- Explain perform indices and performance criteria for servo systems and discuss the mechanical considerations of servo systems.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Industrial Servo Control Systems Fundamentals and Applications | George W. Younkin | Marcel Dekker | 1st Edition, 2003 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Servo Motors and Industrial Control Theory | Riazollah Firoozian | Springer | 2nd Edition, 2014 |
| 2 | DC SERVOS Application and Design with MATLAB | Stephen M. Tobin | CRC | 1st Edition, 2011 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER –VI | | | |
|---|---|---|---|
| **PLC and SCADA (Open Elective)** | | | |
| Course Code | **18EE652** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering theladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays.
- To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions.
- To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
- To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction.
- To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions.
- To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations.
- To describe the operation of bit and word shift registers and develop programs that use shift registers.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. ∎

**Module-1**

**Programmable Logic Controllers:** Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

**PLC Hardware Components:** The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

**Basics of PLC Programming:** Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation ∎

**Module-2**

**Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs:** Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

**Programming Timers:** Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers. ∎

**Module-3**

**Programming Counters:** Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

**Program Control Instructions:** Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■

**Module-4**

**Data Manipulation Instructions:** Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.

**Math Instructions:** Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■

**Module-5**

**Sequencer and Shift Register Instructions:** Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.

**Process Control, Network Systems, and SCADA:** Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions
- Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.
- Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Textbook**

| | | | | |
|---|---|---|---|---|
| 1 | Programmable Logic Controllers | Frank D Petruzella | McGraw Hill, | 4th Edition, 2011 |

**Reference Book**

| | | | | |
|---|---|---|---|---|
| 1 | Programmable Logic Controllers an Engineer's Guide | E A Parr | Newnes | 3rd Edition, 2013 |
| 2 | Introduction Programmable Logic Controllers | Gary Dunning | Cengage | 3rd Edition, 2006 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)<br>SEMESTER –VI | | | |
|---|---|---|---|
| **RENEWABLE ENERGY RESOURCES( Open Elective )** | | | |
| Course Code | **18EE653** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships
- To discuss about solar energy reaching the Earth's surface and solar thermal energy applications.
- To discuss types of solar collectors, their configurations and their applications
- To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
- To discus benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
- To discuss wind turbines, wind resources, site selection for wind turbine
- To discuss geothermal systems, their classification and geothermal based electric power generation
- To discuss waste recovery management systems, advantages and disadvantages
- To discuss biomass production, types of biomass gasifiers, properties of producer gas.
- To discuss biogas, its composition, production, benefits.
- To discuss tidal energy resources, energy availability, power generation.
- To explain motion in the sea wave, power associated with sea wave and energy availability and the devices
- for harnessing wave energy.

**Module-1**

**Introduction:** Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

**Energy from Sun:** Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications. ■

**Module-2**

**Solar Thermal Energy Collectors:** Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.

**Solar Cells:** Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems. ■

**Module-3**

**Hydrogen Energy:** Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.

**Wind Energy:** Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection. **Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects. **Solid waste and Agricultural Refuse:** Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■

**Module-4**

**Biomass Energy:** Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.

**Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.

**Tidal Energy:** Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. ■

**Module-5**

**Sea Wave Energy:** Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.

**Ocean Thermal Energy:** Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
- Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
- Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
- Discuss production of energy from biomass, biogas.
- Summarize tidal energy resources, sea wave energy and ocean thermal energy. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

| | | | | |
|---|---|---|---|---|
| **Textbook** | | | | |
| 1 | Nonconventional Energy Resources | ShobhNath Singh | Pearson | 1st Edition, 2015 |
| **Reference Books** | | | | |
| 1 | Nonconventional Energy Resources | B.H. Khan | McGraw Hill | 3rd Edition, |
| 2 | Renewable Energy; Power for a sustainable Future | Godfrey Boyle | Oxford | 3rd Edition, 2012 |
| 3 | Renewable Energy Sources: Their Impact on global Warming and Pollution | TasneemAbbasi S.A. Abbasi | PHI | 1st Edition, 2011 |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER –VI**

**TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS (Open Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE654** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- Describe the process to plan, control and implement commissioning of electrical equipment's.
- Differentiate the performance specifications of transformer and induction motor.
- Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
- Identification of tools and equipment's used for installation and maintenance of electrical equipment.
- Explain the operation of an electrical equipment's such as isolators, circuit breakers, insulators and switchgears.

**Module-1**

**Electrical Tools, accessories:** Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safely Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices.

**Transformers:** Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions. ■

**Module-2**

**Synchronous Machines:** Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses,
Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance. ■

**Module-3**

**Induction Motor:** Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Test. ■

**Module-4**

**Laying of Underground Cables:** Inspection, Storage, Transportation and Handling of Cables, Cable Handing Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights. ■

**Module-5**

**Switchgear and Protective Devices:** Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.

**Domestic Installation:** Introduction, Testing of Electrical Installation of a Building, Testing of Insulation Resistance to Earth, Testing of Insulation and Resistance between Conductors Continuity or Open Circuit Test, Short Circuit Test, Testing of Earthing Continuity, Location of Faults, IE Rules for Domestic Installation. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Describe the process to plan, control and implement commissioning of electrical equipment's.
- Differentiate the performance specifications of transformer and induction motor.
- Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
- Describe corrective and preventive maintenance of electrical equipment's.
- Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text/ Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Testing, Commissioning, Operation and | S. Rao | Khanna Publishers | 6th Edition, 19th Reprint, 2015 |
| 2 | Testing and Commissioning of Electrical | R.L.Chakrasali | Prism Books Pvt Ltd | 1st Edition,2014 |
| 3 | Preventive Maintenance of Electrical Apparatus | S.K.Sharotri | Katson Publishing House | 1st Edition, 1980 |
| 4 | Handbook of Switchgears | BHEL | McGraw Hill | 1st Edition, 2005 |
| 5 | Transformers | BHEL | McGraw Hill | 1st Edition, 2003 |
| 6 | The J&P Transformer Book | Martin J. Heathcote | Newnes | 12th Edition, 1998 |

## B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
## Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
## SEMESTER –VII

### INDUSTRIAL MOTORS & CONTROL ( Open Elective )

| | | | |
|---|---|---|---|
| Course Code | **18EE751** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To provide basic principles and types of electrical motors.
- To study DC motors, performance, control and applications and Selection of the motors for a particular application.
- To study types Starting and Breaking of Motors
- To study different types of Speed Control of Motors
- To study Selection of Motors for Industrial Drives & Economic Selection of Electric Motors
- To impart the knowledge of Electrical Drawings, Installation, Maintenance & Safety of Electrical Installation. ■

**Module-1**

**Types of Motors DC Motor:** Motor Principle, Back emf, Equivalent Circuit of DC Motor Armature, Torque, Types, Characteristics of Shunt Series and Compound Motors.
**3 phase Induction Motor:** Principle of operation, Speed and Slip, Frequency of Rotor Voltage and Current, Torque of an Induction Motor, Maximum Torque, Torque Slip and Torque Slip Characteristics.
**Single Phase Induction Motors:** Production of Rotating Field, Single Phase Induction Motor Principle, Types of Single Phase Induction Motors. ■

**Module-2**

**Starting and Breaking of Motors:**
**DC Motor:** Necessity of Starter, Three Point and Four Point Starter, Representation of on four quadrant diagram, Electric breaking of DC motor, Regenerative Breaking and Plugging or Reverse Current Breaking.
**Induction Motor:** Staring of Gauge Motors – DOL, Star Delta, Auto Transformers Starters, Slip Ring Induction Motors Starters, Regenerative braking of induction motor, Plugging Braking of induction motor. ■

**Module-3**

**Speed Control of Motors:**
**DC Motor:** Rheostatic Control, Field Flux Control, Armature Voltage Control (Ward –Leonard Method) and Solid State Control (Block Diagram Approach Only).
**Induction Motor:** Pole Changing Method, Stator Voltage Control, Rotor Resistance Control, Slip Energy Recovery. ■

**Module-4**

**Selection of Motors for Industrial Drives and Applications:**
**Selection of Motors:** Introduction, Power Range for Motors and Drives, Load Requirements – Torque–Speed Characteristics, General Application Considerations. Economic Selection of Electric Motors.
**Motor Applications:** Motors for Textile, Machine Tool, Cranes, Compressors, Water Supply, Coal Mining and Rolling Mills applications. ■

**Module-5**

**Electrical Installation for Motors:** Introduction, Motor Terminal Connections, Motor Nameplate Details, Important Consideration Regarding Motor Installation Wiring, Determination of Input Power and Current, Determination of Rating of Cables. Determination of Rating of Fuses, Determination of Size of Conduit, Distribution Board, Main Switch and Starter, Problems on Estimation of material required of Motor Installation.
**Maintenance and Safety:** Motor Maintenance, Troubleshooting Motors, Protection of motor for specific conditions, maintenance of motors, Motor faults and causes. Contactor Ratings: NEMA Ratings, IEC Ratings, Protecting against Electrical Shock, Grounding and Bonding, Lockout and Tagout, Electrical Codes and Standards. ■

**Course Outcomes:** At the end of the course, the student will be able to

- Basic principles of electric motors explain the procedure of selecting rating of the motor for any application.
- Classify DC motors, explain the torque speed characteristics and select a motor for an application.
- Classify Induction Motors, explain the torque speed characteristics and select a motor for an application.
- Explain the types of Starting and Breaking of Motors
- Explain the different types of Speed Control of Motors
- Selection of Motors for Industrial Drives & Economic Selection of Electric Motors.
- Discuss Electrical Drawings, Installation, Maintenance & Safety ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Electric Machines | Ashfaq Husain | Dhanpat Rai & Co | 2013 |
| 2 | Electric Motor Drives, Fundamentals, Types and Applications | Austin Hughes | Elsevier ,Third edition | 2006 |
| 3 | Electrical motors applications and control. | M V Deshapande | PHI publications | 2010 |
| 4 | Electric Motors and Control Systems-Career Education | Frank Petruzella | McGraw-Hill Companies, Inc. | 2010 |
| 5 | A Course in Electrical Installation Estimating & Costing | J, B, Gupta | S. K. Kataria & Sons 9th Edition | 2012 |

**. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER –VII**

**SENSORS AND TRANSDUCERS (Open Elective)**

| | | | |
|---|---|---|---|
| Course Code | **18EE752** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss need of transducers, their classification, advantages and disadvantages.
- To discuss working of different types of transducers and sensors.
- To discuss recent trends in sensor technology and their selection.
- To discuss basics of signal conditioning and signal conditioning equipment.
- To discuss configuration of Data Acquisition System and data conversion.
- To discuss the basics of Data transmission and telemetry.
- To explain measurement of various non-electrical quantities.

**Module-1**

**Sensors and Transducers:** Introduction, Classification of Transducers**,** Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.

**Module-2**

**Sensors and Transducers (continued):** Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems.

**Module-3**

**Signal Condition:**Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.

**Data Acquisition Systems and Conversion:** Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion.

**Module-4**

**Data Transmission and Telemetry:** Data/Signal Transmission, Telemetry.

**Measurement of Non – Electrical Quantities:** Pressure Measurement

**Module-5**

**Measurement of Non – Electrical Quantities (continued):**Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity.

**Course Outcomes:** At the end of the course the student will be able to:

- Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
- Explain the working of various transducers and sensors.
- Outline the recent trends in sensor technology and their selection.
- Analyze the signal conditioning and signal conditioning equipment.
- Illustrate different configuration of Data Acquisition System and data conversion.
- Show knowledge of data transmission and telemetry.
- Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Electrical and Electronic Measurements and instrumentation | R.K Rajput | S. Chand | 3rd Edition, 2013. |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | A Course in Electronics and Electrical Measurements and Instruments | J.B. Gupta | Katson Books | 13th Edition, 2008 |
| 2 | A Course in Electrical and Electronic Measurements and Instrumentation | A. K. Sawheny | DhanpatRai | 2015 |

**. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –VII**

**ELECTRIC VEHICLES (Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | **18EE753** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To Understand the fundamental laws and vehicle mechanics.
- To Understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles. ■

**Module-1**

**Vehicle Mechanics**

Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design. ■

**Module-2**

**Electric and Hybrid Electric Vehicles**

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. ■

**Module-3**

**Energy storage for EV and HEV**

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors. ■

**Module-4**

**Electric Propulsion**

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. ■

**Module – 5**

**Design of Electric and Hybrid Electric Vehicles**

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
- Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
- Model batteries, Fuel cells, PEMFC and super capacitors.
- Analyze DC and AC drive topologies used for electric vehicle application.
- Develop the electric propulsion unit and its control for application of electric vehicles.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Books**

| | | | | |
|---|---|---|---|---|
| 1 | Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design | M. Ehsani, Y. Gao, S. Gay and Ali Emadi | CRC Press | 2005 |
| 2 | Electric and Hybrid Vehicles: Design Fundamentals | Iqbal Husain | CRC Press | 2003 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles | Sheldon S. Williamson | Springer | 2013 |
| 2 | Modern Electric Vehicle Technology | C.C. Chan and K.T. Chau | OXFORD University | 2001 |
| 3 | Hybrid Electric Vehicles Principles And Applications With Practical Perspectives | Chris Mi, M. Abul Masrur, David Wenzhong Gao | Wiley Publication | 2011 |

**B . E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –VII**

**ELECTRICAL ENERGY CONSERVATION AND AUDITING (Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | **18EE754** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- Understand the current energy scenario and importance of energy conservation.
- Understand the methods of improving energy efficiency in different electrical systems.
- Realize energy auditing.
- Explain about various pillars of electricity market design.
- To explain the scope of demand side management, its concept and implementation issues and strategies.

**Module-1**

**Energy Scenario:** Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features. ■

**Module-2**

**Energy Efficiency in Electrical Systems:** Electricity billing, Electrical load management and maximum demand Control, Maximum demand controllers; Power factor improvement, Automatic power factor controllers, efficient operation of transformers, energy efficient motors, Soft starters, Variable speed drives; Performance evaluation of fans and pumps, Flow control strategies and energy conservation opportunities in fans and pumps, Electronic ballast, Energy efficient lighting and measures of energy efficiency in lighting system. ■

**Module-3**

**Energy auditing:** Introduction, Elements of energy audits, different types of audit, energy use profiles measurements in energy audits, presentation of energy audit results. ■

**Module-4**

**Electricity vis-à-vis Other Commodities:** Distinguishing features of electricity as a commodity, Four pillars of market design: Imbalance, Scheduling and Dispatch, Congestion Management, Ancillary Services. Framework of Indian power sector and introduction to the availability based tariff (ABT). ■

**Module-5**

**Energy Audit Applied to Buildings:** Energy – Saving Measures in New Buildings, Water Audit, Method of Audit, General Energy – Savings Tips Applicable to New as well as Existing Buildings. Demand side Management: Scope of DSM, Evolution of DSM concept, DSM planning and Implementation, Load management as a DSM strategy, Applications of Load Control, End use energy conservation, Tariff options for DSM. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Analyze about energy scenario nationwide and worldwide , also outline Energy Conservation Act and its features.
- Discuss load management techniques and energy efficiency.
- Understand the need of energy audit and energy audit methodology.
- Understand various pillars of electricity market design.
- Conduct energy audit of electrical systems and buildings.
- Show an understanding of demand side management and energy conservation. ■

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Books**

| | | | |
|---|---|---|---|
| 1 | Energy Management Handbook | W.C. Turner | Publisher John Wiley and Sons |
| 2 | Energy Efficient Electric Motors and Applications | H.E. Jordan | Plenum Pub. Corp |
| 3 | Energy Management Author Publisher | W. R. Murphy, G. Mckay | Butterworths |

**Reference Books**

| | | | |
|---|---|---|---|
| 1 | Energy Science Principles, Technologies and Impact, | J. Andrews, N. Jelley | Oxford University Press. |
| 2 | Market operations in power systems: Forecasting, Scheduling, and Risk Management, | Shahedepour M.,Yamin H., Zuyi Li. | John Wiely & Sons, New York |
| 3 | Energy Conservation | Diwan, P. | Pentagon Press (2008) |

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
## Scheme of Teaching and Examination 2018 – 19
## Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
## (Effective from the academic year 2018 – 19)

**VIII SEMESTER**

| Sl. No | Course and Course code | | Course Title | Teaching Department | Teaching Hours /Week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | | | | | |
| 1 | PCC | 18EE81 | Power System Operation and Control | EEE | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 2 | PEC | 18EE82X | Professional Elective - 4 | EEE | 3 | -- | -- | 03 | 40 | 60 | 100 | 3 |
| 3 | Project | 18EEP83 | Project Work Phase - 2 | | -- | -- | 2 | 03 | 40 | 60 | 100 | 8 |
| 4 | Seminar | 18EES84 | Technical Seminar | | -- | -- | 2 | 03 | 100 | -- | 100 | 1 |
| 5 | Internship | 18EEI85 | Internship | Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.) | | | | 03 | 40 | 60 | 100 | 3 |
| | | | | **TOTAL** | **06** | **--** | **04** | **15** | **260** | **240** | **500** | **18** |

**Note:** PCC: Professional Core, PEC: Professional Elective.

**Professional Electives - 4**

| Course code under 18XX82X | Course Title |
|---|---|
| 18EE821 | FACTs and HVDC Transmission |
| 18EE822 | Electrical Estimation and Costing |
| **18EE823** | **Big Data Analytics in Power Systems** |
| 18EE824 | Power System Planning |
| 18EE825 | Electrical Power Quality |

**Project Work**

**CIE procedure for Project Work Phase - 2:**

**(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**SEE for Project Work Phase - 2:**

**(i) Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

**ii) Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

**Internship:** Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

**AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

## VIII SEMESTER DETAILED SYLLABUS

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VIII**

**POWER SYSTEM OPERATION AND CONTROL(Core Course)**

| | | | |
|---|---|---|---|
| Course Code | **18EE81** | CIE Marks | 40 |
| Number of Lecture Hours/Week | 3:0:0 | SEE Marks | 60 |
| **Credits** | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To describe various levels of controls in power systems and the vulnerability of the system.
- To explain components, architecture and configuration of SCADA.
- To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control
- To explain automatic generation control, voltage and reactive power control in an interconnected power system.
- To explain reliability and contingency analysis, state estimation and related issues. ■

**Module-1**

**Introduction:** Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centers. R1

**Supervisory Control and Data acquisition (SCADA):** Introduction, components, application in Power System, basic functions and advantages. Building blocks of SCADA system, components of RTU, communication subsystem, IED functional block diagram. R2

**Classification of SCADA system:** Single master–single remote; Single master–multiple RTU; Multiple master–multiple RTUs; and Single master, multiple submaster, multiple remote. ■ R2

**Module-2**

**Automatic Generation Control (AGC):** Introduction, Schematic diagram of load frequency and excitation voltage regulators of turbo generators, Load frequency control (Single area case), Turbine speed governing system, Model of speed governing system, Turbine model, Generator load model, Complete block diagram of representation of load frequency control of an isolated power system, Steady state analysis, Control area concept, Proportional plus Integral Controller. ■ T1

**Module-3**

**Automatic Generation Control in Interconnected Power system:** Two area load frequency control, Optimal (Two area) load frequency control by state variable, Automatic voltage control, Load frequency control with generation rate constraints (GRCs), Speed governor dead band and its effect on AGC, Digital LF Controllers, Decentralized control. ■ T1

**Module-4**

**Control of Voltage and Reactive Power:** Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Methods of voltage control: i. Injection of reactive power, Shunt capacitors and reactors, Series capacitors, Synchronous compensators, Series injection. ii Tap changing transformers. Combined use of tap changing transformers and reactive power injection, Booster transformers, Phase shift transformers, Voltage collapse. ■ T3

**Module-5**

**Power System Security:** Introduction, Factors affecting power system security, Contingency Analysis, Linear Sensitivity Factors, AC power flow methods, Contingency Selection and Ranking. T2

**State estimation of Power Systems:** Introduction, Linear Least Square Estimation. T2

**Course Outcomes:** At the end of the course the student will be able to:

- Describe various levels of controls in power systems, architecture and configuration of SCADA.
- Develop and analyze mathematical models of Automatic Load Frequency Control.
- Develop mathematical model of Automatic Generation Control in Interconnected Power system
- Discuss the Control of Voltage , Reactive Power and Voltage collapse.
- Explain security, contingency analysis, state estimation of power systems.

**Question paper pattern:**

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

**Text Book**

| | | | | |
|---|---|---|---|---|
| 1 | Modern Power System Analysis | D. P. Kothari | McGraw Hill | 4th Edition, 2011 |
| 2 | Power Generation Operation and Control | Allen J Wood etal | Wiley | 2nd Edition,2003 |
| 3 | Electric Power Systems | B M Weedy, B J C | Wiley | 4th Edition, 2012 |

**Reference Books**

| | | | | |
|---|---|---|---|---|
| 1 | Computer-Aided Power System Analysis | G. L. Kusic | CRC Press | 2nd Edition.2010 |
| 2 | Power System SCADA and Smart Grid | Mini S Thom and John D. McDonald | CRC Press | 2015 |
| 3 | Power System Stability and Control | Kundur | McGraw Hill | 8th Reprint, 2009 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **FACTS AND HVDC TRANSMISSION (PROFESSIONAL ELECTIVE)** | | | |
| Course Code | 18EE821 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

• To discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.

• To explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.

• To describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.

• To describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.

• To explain advantages of HVDC power transmission, overview and organization of HVDC system.

• To describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.

• Explain converter control for HVDC systems, commutation failure, control functions.

**Module-1**

**FACTS Concept and General System Considerations:** Transmission Interconnections, Flow of Power in an AC System, What Limits the Loading Capability? Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers, Checklist of Possible Benefits from FACTS Technology, In Perspective: HVDC or FACTS.

**Module-2**

**Static Shunt Compensators:** Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability. Methods of Controllable Var Generation –Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC).Operation of Single Phase TSC – TSR. Switching Converter Type Var Generators, Basic Operating Principles, Basic Control Approaches.

**Static VAR Compensators**: SVC and STATCOM, the Regulation Slope. Comparison between STATCOM and SVC, V –I and V –Q Characteristics, Transient stability**,** Response Time.

**Module-3**

**Static Series Compensators:** Objectives of Series Compensation, Concept of Series Capacitive Compensation, Voltage Stability, Improvement of Transient Stability. GTO Thyristor-Controlled Series Capacitor, Thyristor-Switched Series Capacitor, Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator, Transmitted Power Versus Transmission Angle Characteristic.

**Module-4**

**Development of HVDC Technology:** Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, HVDC Characteristics and Economic Aspects.

**Power Conversion:** 3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter.

**Module-5**

**Control of HVDC Converter and System:** Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design, HVDC Control Functions, Reactive Power and Voltage Stability.

**Course Outcomes:** At the end of the course the student will be able to:

• Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.

• Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.

| |
|---|
| • Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.<br>• Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.<br>• Explain advantages of HVDC power transmission, overview and organization of HVDC system.<br>• Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.<br>• Explain converter control for HVDC systems, commutation failure, control. |
| **Question paper pattern:**<br>• The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub- questions) from each module.<br>• Each full question will have sub- question covering all the topics under a module.<br>• The students will have to answer five full questions, selecting one full question from each module. |

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems | Narain G Hingorani, Laszlo Gyugyi | Wiley | 1st Edition, 2000 |
| 2 | HVDC Transmission: Power Conversion Applications in Power Systems | Chan-Ki Kim et al | Wiley | 1st Edition, 2009 |
| **Reference Books** | | | | |
| 1 | Thyristor Based FACTS Controllers for Electrical Transmission Systems | R. Mohan Mathur, Rajiv K. Varma | Wiley | 1st Edition, 2002 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **ELECTRICAL ESTIMATION AND COSTING (PROFESSIONAL ELECTIVE)** | | | |
| Course Code | 18EE822 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss the purpose of estimation and costing.
- To discuss market survey, estimates, purchase enquiries, tenders, comparative statement and payment of bills and Indian electricity act and some of the rules.
- To discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories, fittings and fuses.
- To discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
- To discuss different types of service mains and estimation of power circuits.
- To discuss estimation of overhead transmission and distribution system and its components.
- To discuss main components of a substation, their graphical representation and preparation of single line diagram of a substation.

**Module-1**

**Principles of Estimation:** Introduction to Estimation and Costing, Electrical Schedule, Catalogues, Market Survey and Source Selection, Recording of Estimates, Determination of Required Quantity of Material, Labour Conditions, Determination of Cost Material and Labour, Contingencies, Overhead Charges, Profit, Purchase System, Purchase Enquiry and Selection of Appropriate Purchase Mode, Comparative Statement, Purchase Orders, Payment Of Bills, Tender Form, General Idea about IE Rule, Indian Electricity(IE) Act and IE Rules -29,30,45,46,47,50,51,54,55,77 and79.

**Module-2**

**Wiring:** Introduction, Distribution of energy in a Building, PVC Casing and Capping, Conduit Wiring, Desirabilities of Wiring. Types of cables used in Internal Wiring, Multi Strand Cables, Voltage Grading and Specification of Cables.

**Wiring (continued):** Main Switch and Distribution Board, Conduits and its accessories and Fittings. Lighting Accessories and Fittings, Types of Fuses, Size of Fuse, Fuse Units, Earthing Conductor.

**Internal Wiring:** General rules for wiring, Design of Lighting Points (Refer to Seventh Chapter of the Text Book), Number of Points, Determination of Total Load, Number of Sub –Circuits, Ratings Main Switch and Distribution Board and Size of Conductor. Current Density, Layout.

**Module-3**

**Service Mains:** Introduction, Types, Estimation of Underground and Overhead Service Connections. Design and Estimation of Power Circuits: Introduction, Important Considerations Regarding Motor Installation Wiring, Input Power, Input Current to Motors, Rating of Cables, Rating of Fuse, Size of Condit, Distribution Board Main Switch and Starter.

**Module-4**

**Estimation of Overhead Transmission and Distribution Lines:** (Review of Line Supports, Conductor Materials, Size of Conductor for Overhead Transmission Line, Types of Insulators) [No Question Shall be Set From the Review Portion].

Cross Arms, Pole Brackets and Clamps, Guys and Stays, Conductors Configuration Spacing and Clearances, Span Lengths, Lightning Arrestors, Phase Plates, Danger Plates, Anti Climbing Devices, Bird Guards, Beads of Jumpers, Muffs, Points to be Considered at the Time of Erection of Overhead Lines, Erection of Supports, Setting of Stays, Fixing of Cross Arms, Fixing of Insulators, Conductor Erection. Repairing and Jointing of Conductors, Dead End Clamps, Positioning of Conductors and Attachment to Insulator s, Jumpers, Tee-Offs, Earthing of Transmission Lines, Guarding of Overhead Lines, Clearances of Conductor From Ground, Spacing Between Conductors, Important Specifications.

**Module-5**

| | | | | |
|---|---|---|---|---|
| **Estimation of Substations:** Main Electrical connection, Graphical Symbols for Various Types of Apparatus and Circuit Elements on Substation main Connection Diagram, Single Line Diagram of Typical Substations, Equipment for Substation, Substation Auxiliaries Supply, Substation Earthing. | | | | |
| **Course Outcomes:** At the end of the course the student will be able to:<br>• Discuss wiring methods, cables used, design of lighting points and sub-circuits, internal wiring, wiring accessories and fittings, fuses and types.<br>• Discuss estimation of service mains and power circuits.<br>• Discuss estimation of overhead transmission and distribution system its components.<br>• Discuss types of substation, main components and estimation of substation. | | | | |
| **Question paper pattern:**<br>• The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub- questions) from each module.<br>• Each full question will have sub- question covering all the topics under a module.<br>• The students will have to answer five full questions, selecting one full question from each module. | | | | |
| | | | | |
| **Sl No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| **Textbook** | | | | |
| 1 | A Course in Electrical Installation Estimating and Costing | J. B. Gupta | Katson Books | 9th Edition, 2012 |
| | | | | |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **BIG DATA ANALYTICS IN POWER SYSTEMS (PROFESSIONAL ELECTIVE)** | | | |
| Course Code | 18EE823 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course objectives:**

- To define big data and to explain big data application and analytics to power systems.
- To explain the role of big data in smart grid communications and optimization of big data in electric power systems.
- To explain security methods for the infrastructure communication and data mining methods for theft detection in power systems.
- To explain the application of unit commitment method in the control of smart grid.
- To explain protection algorithm for transformer based on data pattern recognition.

**Module-1**

**Introduction:** Big Data, Future Power Systems.
**Big Data Application and Analytics in a Large - Scale Power System:** Introduction, General Applications of Big Data, Algorithms for Processing Big Data, Application of Big Data in Power Systems.

**Module-2**

**Role of Big Data in Smart Grid Communications:** Introduction, The Grid Modernization, The Grid Interconnection with the Internet of Things, Data Traffic Pattern in a Smart Grid Environment, The Massive Flow of Information in a Smart Scenario ,The Volume of Generated Data in a Smart Distribution System: A Case of Study.
**Big Data Optimization in Electric Power Systems:** Introduction, Background, Scientometric Analysis of Big Data, Big Data and Power Systems, Optimization Techniques Used in the Big Data Analysis.

**Module-3**

**Security Methods for Critical Infrastructure Communications:** Introduction, Effects of Successful Communication System Threats, General Communication System Operations, Industrial Control Networks and Operations, High-Level Communication System Threats, Cyber Threats and Security. **Data - Mining Methods for Electricity Theft Detection:** Introduction, Transmission and Distribution System Losses, Electricity Theft Methods, Data Mining and Electricity Theft, Issues and Directions in Electricity Theft-Related Data-Mining Research.

**Module-4**

**Unit Commitment Control of Smart Grids:** Introduction, Renewable Energy Resources, The Unit Commitment Problem, A Multi-agent Architecture, Illustrative Example.

**Module-5**

**Transformer Differential Protection Algorithm Based on Data Pattern Recognition:** Big Data and Power System Protection, Methods for Differential Protection Blocking, Principal Component Analysis, Curvilinear Component Analysis (CCA), PCA Applied to Discriminate Between Inrush and Fault, Currents in Transformers, Application of the CCA as a Base for a Differential Protection System Under Study, Results.

**Course outcomes:**

At the end of the course the student will be able to:

- Discuss role of big data and machine-learning methods applicable to power systems and in particular to Smart Grid communications.
- Discuss optimization methods which are suitable for big data models in power systems.
- Discuss various cyber security issues, electricity theft detection and mitigation that exist in IoT-enabled future power systems.
- Discuss renewable energy planning concerns associated with planned future power systems that have high renewable penetration.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook** | | | | |
| 1 | Big Data Analytics in Future Power Systems | Ahmed F. Zobaa and Trevor J. Bihl | CRC Press | 2019. |

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)**
**SEMESTER – VIII**

**POWER SYSTEM PLANNING (PROFESSIONAL ELECTIVE)**

| | | | |
|---|---|---|---|
| Course Code | 18EE824 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- To discuss primary components of power system planning namely load furcating, evaluation of energy resources, provisions of electricity Act and Energy Conservation Act.
- To explain planning methodology for optimum power system expansion, various types of generation, transmission and distribution.
- To explain forecasting of anticipated future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.
- To discuss methods to mobilize resources to meet the investment requirement for the power sector.
- To perform economic appraisal to allocate the resources efficiently and take proper investment decisions
- To discuss expansion of power generation and planning for system energy in the country
- To discuss evaluation of operating states of transmission system, their associated contingencies and determination of the stability of the system for worst case conditions
- To discuss principles of distribution planning, supply rules, network development and the system studies.
- To discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis.
- To discuss grid reliability, voltage disturbances and their remedies.
- To discuss planning and implementation of electric –utility activities designed to influence consumer uses of electricity.
- To discuss market principles and the norms framed by CERC for online trading and exchange in the interstate power market.

**Module-1**

**Power System:** Planning Principles, Planning Process, Project Planning, Power Development, National and Regional Planning, Enterprise Resources Planning, Planning Tools, Power Planning Organisation, Scenario Planning.

**Electricity Forecasting:** Load Requirement, System Load, Electricity Forecasting, Forecasting Techniques, Forecasting Modelling, Spatial – Load Forecasting, Peak Load - Forecast, Reactive – Load Forecast, Unloading of a System.

**Module-2**

**Power-System Economics:** Financial Planning, Techno – Economic Viability, Private Participation, Financial Analysis, Economic Analysis, Transmission, Rural Electrification Investment, Total System Analysis, Credit - Risk Assessment.

**Generation Expansion:** Generation Capacity and Energy, Generation Mix, Clean Coal Technologies Renovation and Modernisation of Power Plants.

**Module-3**

**Transmission Planning:** Transmission Planning Criteria, Right – of – Way, Network Studies, High – Voltage Transmission, HVDC Transmission, Conductors, Sub – Stations, Power Grid, Reactive Power Planning, Energy Storage.

**Module-4**

**Distribution:** Distribution Deregulation, Planning Principles, Electricity – Supply Rules, Criteria and Standards, Sub – Transmission, Basic Network, Low Voltage Direct Current Electricity, Upgradation of Existing Lines and Sub – Stations, Network Development, System Studies, Urban Distribution, Rural Electrification.

**Reliability and Quality:** Reliability Models, System Reliability, Reliability and Quality Planning, Functional Zones, Generation Reliability Planning Criteria, Transmission Reliability Criteria, Distribution Reliability, Reliability Evaluation, Grid Reliability, Quality of Supply.

**Module-5**

**Demand-Side Planning:** Demand Response, Demand – Response Programmes, Demand– Response Technologies, Energy Efficiency, Energy - Economical Products, Efficient – Energy Users, Supply – Side Efficiency, Energy Audit.
**Electricity Market:** Market Principles, Power Pool, Independent System Operator, Distribution SystemOperator, Power Markets, Market Rules, Bidding, Trading, Settlement System, Merchant Power, Differential Electricity, Congestion Management, Ancillary Services, Hedging, Smart Power Market.

**Course Outcomes:** At the end of the course the student will be able to:

- Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting.
- Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions
- Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.
- Discuss principles of distribution planning, supply rules, network development and the system studies
- Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies
- Discuss planning and implementation of electric –utility activities, market principles and the norms framed.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook** | | | | |
| 1 | Electric Power Planning | A. S. Pabla | McGraw Hill | 2nd Edition, 2016 |

| B. E. ELECTRICAL AND ELECTRONICS ENGINEERING<br>CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)<br>SEMESTER – VIII | | | |
|---|---|---|---|
| **ELECTRICAL POWER QUALITY (PROFESSIONAL ELECTIVE)** | | | |
| Course Code | 18EE825 | CIE Marks | 40 |
| Teaching Hours/Week (L:T:P) | (3:0:0) | SEE Marks | 60 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning Objectives:**

- Review definitions and standards of common power quality phenomena.
- Understand power quality monitoring and classification techniques.
- Investigate different power quality phenomena causes and effects.
- Understand different techniques for power quality problems mitigation.
- Understand the various power quality phenomenon, their origin and monitoring and mitigation methods.
- Understand the effects of various power quality phenomenon in various equipment.

**Module-1**

**Introduction:** Power quality-voltage quality, power quality evaluation procedures term and definitions: general classes of power quality problems, transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion, power quality terms.

**Module-2**

**Voltage sags and interruptions:** Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, motor starting sags.

**Transient over voltages:** Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients.

**Module-3**

**Transient over voltages:** Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion, intra harmonics.

**Module-4**

**Applied harmonics:** Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics.

**Power Quality Benchmark:** Introduction, benchmark process, power quality contract.

**Module-5**

**Power quality benchmark:** power quality state estimation, including power quality in distribution planning.

**Distributed generation and quality:** DG technologies, interface to utility system, power quality issues, interconnection standards.

**Course Outcomes:** At the end of the course the student will be able to:

- Define Power quality; evaluate power quality procedures and standards.
- Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.
- Identify various sources of harmonics, explain effects of harmonic distortion.
- Evaluate harmonic distortion, control harmonic distortion.
- Estimate power quality in distribution planning. Identify power quality issues in utility system.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

| Sl No | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbook** | | | | |

| | | | | |
|---|---|---|---|---|
| 1 | Electric Power Quality | Dugan, Roger C | McGraw-Hill | 2003 |
| **Reference Books** | | | | |
| 1 | Electric Power Quality | G.T.Heydt | Stars in a circle publications | 1991 |
| 2 | Understanding power quality problems voltage sags and interruptions | Math H. J. Bollen. | IEEE Press | 2000 |
| 3 | Power quality in power systems and electrical machines | Ewald F Fuchs, Mohammad, A.S., Masoum | Academic Press, Elsevier | 2009 |
| | | | | |

******END******

**B.E. ELECTRICAL & ELECTRONICS ENGINEERING**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**SEMESTER -VIII**

**PROJECT WORK PHASE -II**

| | | | |
|---|---|---|---|
| Course Code | 18EEP83 | CIE Marks | 40 |
| Contact Hours/Week | 02 | SEE Marks | 60 |
| Credits | 08 | Exam Hours/Batch | 03 |

**Course objectives:**

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■

**Project Work Phase - II:**Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

| | |
|---|---|
| **Revised Bloom's Taxonomy Level** | $L_3$ – Applying, $L_4$ – Analysing, $L_5$ – Evaluating, $L_6$ – Creating |

**Course outcomes:**

At the end of the course the student will be able to:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it. ■

**CIE procedure for Project Work Phase - 2:**

**(i)Single discipline:**The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:**Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.■

**Semester End Examination**

SEE marks for the project (60 marks)shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) as per the University norms by the examiners appointed VTU.■

| B.E. ELECTRICAL & ELECTRONICS ENGINEERING<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)<br>SEMESTER -VIII | | | |
|---|---|---|---|
| **TECHNICAL SEMINAR** | | | |
| Course Code | 18EES84 | CIE Marks | 100 |
| Contact Hours/Week | 02 | SEE Marks | -- |
| Credits | 01 | Exam Hours | -- |

## Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.

- Carryout literature survey, organize the seminarcontent in a systematic manner.
- Prepare the report with own sentences, avoiding cut and paste act.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■

| | |
|---|---|
| **Revised Bloom's Taxonomy Level** | $L_3$ – Applying, $L_4$ – Analysing, $L_5$ – Evaluating, $L_6$ – Creating |

## Course outcomes:

At the end of the course the student will be able to:

- Attain, use and develop knowledge in the field of engineering and other disciplines through independent learning and collaborative study.
- Identify, understand and discuss current, real-time issues.
- Improve oral and written communication skills.
- Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.■

**Evaluation Procedure:**

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior most acting as the Chairman.

**Marks distribution for CIE of the course:**

Seminar Report:50 marks

Presentation skill:25 marks

Question and Answer:25 marks.■

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII / VIII**

**INTERNSHIP**

| | | | |
|---|---|---|---|
| Course Code | **18EEI85** | CIE Marks | 40 |
| Number of Practical Hours/Week | -- | SEE Marks | 60 |
| **Credits** | **03** | Exam Hours | 03 |

**Course Learning Objectives:**
Internship provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public. ■

**Internship:** Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

**Seminar:** Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■

**Course Outcomes:** At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills. ■

**Continuous Internal Evaluation**

CIE marks : 40 Marks

i. Successful completion of Internship training in an organization and certification from competitive authority-20 marks
ii. Presentation and report -20 Marks

(based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■

**Semester End Examination**

SEE marks – 60 Marks based on presentation skill, participation in the question and answer session by the student to the examiners appointed by the University.■

# Scheme of Teaching and Evaluation for MBA
# III & IV Semester
# Master of Business Administration (MBA)
## (2022 Scheme)

# III Semester

**3rd Semester Scheme (Course with Dual Specialization)**
**(Effective from the academic year 2022-23)**

## Data Analytics Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBADA301 | Data Analytics For Managers | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBADA302 | Database Management System | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBADA303 | Python Programming For Managers | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBADA304 | Data Warehousing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBADA305 | Decision Support System | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBADA306 | Digital Transformation | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAIN307 | Internship | 0 | 8 | 8 | 50 | 50 | 100 | 4 |
| 8 | 22MBAAT308 | Business Aptitude (Mandatory Non – Credit Course ) | 2 | 2 | 4 | 100 | - | 100 | - |
| | | **Total** | **14** | **22** | **36** | **450** | **350** | **800** | **22** |

## Logistics & Supply Chain Management Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBALS301 | Basics of Logistics and Supply Chain Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBALS302 | Warehouse Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBALS303 | Purchasing and Strategic Sourcing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBALS304 | Inventory Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBALS305 | Supply Chain Management and Risk Modeling | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBALS306 | E-Logistics | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAIN307 | Internship | 0 | 8 | 8 | 50 | 50 | 100 | 4 |
| 8 | 22MBAAT308 | Business Aptitude (Mandatory Non – Credit Course ) | 2 | 2 | 4 | 100 | - | 100 | - |
| | | **Total** | **14** | **22** | **36** | **450** | **350** | **800** | **22** |

## Finance Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBAFM301 | Financial Markets and Services | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBAFM302 | Investment Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBAFM303 | Direct Taxation | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBAFM304 | Advanced Financial Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBAFM305 | Mergers & Acquisition and Business Valuation | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBAFM306 | Financial Modeling | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAIN307 | Internship | 0 | 8 | 8 | 50 | 50 | 100 | 4 |
| 8 | 22MBAAT308 | Business Aptitude (Mandatory Non – Credit Course ) | 2 | 2 | 4 | 100 | - | 100 | - |
| | | **Total** | **14** | **22** | **36** | **450** | **350** | **800** | **22** |

## Marketing Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBAMM301 | Behavioural Marketing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBAMM302 | Advanced Retail Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBAMM303 | Services Marketing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBAMM304 | Marketing Research and Analytics | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBAMM305 | Business Marketing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBAMM306 | Tourism Marketing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAIN307 | Internship | 0 | 8 | 8 | 50 | 50 | 100 | 4 |
| 8 | 22MBAAT308 | Business Aptitude (Mandatory Non – Credit Course ) | 2 | 2 | 4 | 100 | - | 100 | - |
| | | **Total** | **14** | **22** | **36** | **450** | **350** | **800** | **22** |

## Human Resource Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBAHR301 | Talent Acquisition | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBAHR302 | Human Resource Analytics | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBAHR303 | Organizational Change Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBAHR304 | Learning And Development | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBAHR305 | Employee Relations & Labour Laws | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBAHR306 | Human Resource Audit | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAIN307 | Internship | 0 | 8 | 8 | 50 | 50 | 100 | 4 |
| 8 | 22MBAAT308 | Business Aptitude (Mandatory Non – Credit Course ) | 2 | 2 | 4 | 100 | - | 100 | - |
| | | **Total** | **14** | **22** | **36** | **450** | **350** | **800** | **22** |

# IV Semester

**4th Semester Scheme (Course with Dual Specialization)**
**(Effective from the academic year 2022-23)**

**Data Analytics Specialization**

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBADA401 | R Programming For Managers | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBADA402 | Project Management | 3 | 0 | 3 | 50 | 50 | 100 | 3 |
| 3 | 22MBADA403 | Enterprise Resource Planning | 3 | 0 | 3 | 50 | 50 | 100 | 3 |
| 4 | 22MBADA404 | Peoples Analytics | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBADA405 | Business Intelligence | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBADA406 | Corporate Social and Web Analytics | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAPR407 | Project Work | 0 | 16 | 16 | 50 | 50 | 100 | 08 |
| | | **Total** | **14** | **08** | **22** | **350** | **350** | **700** | **26** |

**Logistics & Supply Chain Management Specialization**

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBALS401 | Port and Airport Management for Logistics | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBALS402 | Global Supply Chain Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBALS403 | Export Import Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBALS404 | International Logistics Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBALS405 | Containerization and Multimodal Transportation Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBALS406 | Supply Chain Information System | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAPR407 | Project Work | 0 | 16 | 16 | 50 | 50 | 100 | 08 |
| | | **Total** | **12** | **12** | **24** | **350** | **350** | **700** | **26** |

## Finance Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBAFM401 | Risk Management & Insurance | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBAFM402 | Financial Derivatives | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBAFM403 | Indirect Taxation | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBAFM404 | Wealth Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBAFM405 | Behavioral Finance | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBAFM406 | International Financial Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAPR407 | Project Work | 0 | 16 | 16 | 50 | 50 | 100 | 08 |
| | | **Total** | **12** | **12** | **24** | **350** | **350** | **700** | **26** |

## Marketing Specialization

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBAMM401 | Sales Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBAMM402 | Integrated Marketing Communication & Advertising | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBAMM403 | Digital & Social Media Marketing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBAMM404 | Strategic Brand Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBAMM405 | Rural Marketing | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBAMM406 | International Marketing Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAPR407 | Project Work | 0 | 16 | 16 | 50 | 50 | 100 | 08 |
| | | **Total** | **12** | **12** | **24** | **350** | **350** | **700** | **26** |

**Human Resource Specialization**

| SN | Course Code | Course Name | Teaching hours per week | | | Marks for | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | Lecture | Practical component | Total | CIE | SEE | | |
| 1 | 22MBAHR401 | Leadership & Building Organization | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 2 | 22MBAHR402 | Personal Growth and Interpersonal Effectiveness | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 3 | 22MBAHR403 | International Human Resource Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 4 | 22MBAHR404 | Public Relations | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 5 | 22MBAHR405 | Compensation Management & Reward system | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 6 | 22MBAHR406 | Talent Management | 2 | 2 | 4 | 50 | 50 | 100 | 3 |
| 7 | 22MBAPR407 | Project Work | 0 | 16 | 16 | 50 | 50 | 100 | 08 |
| | | **Total** | **12** | **12** | **24** | **350** | **350** | **700** | **26** |

**Semester: III**
**Course Name: Data Analytics for Managers**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA301** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Wholeness of Data Analytics** **08 Hours**

Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain.
Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications.

**Teaching-Learning Process:**

**Pedagogy:** Lab and Lecture method.

**Module –2 Online Transaction Processing and Data Warehouse** **08 Hours**

Structure, objectives, introduction, online transaction processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market.

**Teaching-Learning Process:**

**Pedagogy:** Lab and Lecture method.

**Module – 3 Business Intelligence And Its Deeper Dynamics** **08 Hours**

Structure, objectives, business intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI.

**Teaching-Learning Process:**

**Pedagogy:** Lab and Lecture method.

**Module – 4 Introduction to Data Visualization** **08 Hours**

Structure, objectives, presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, Sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram.

**Teaching-Learning Process:**

**Pedagogy:** Lab and Lecture method.

**Module – 5 Decision Tree** **08 Hours**

Introduction, decision tree problem, decision tree construction, decision tree algorithms.
**Advanced data visualization**- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.

**Teaching-Learning Process:**

**Pedagogy:** Lab and Lecture method.

**Course Outcomes:**
At the end of the course the student will be able to:
**CO1:** Apply the BI concepts to solve business problems.
**CO2:** Apply the OLTP techniques to provide business solutions
**CO3:** Apply BI techniques to create Data Lake.
**CO4:** Analyse data using various data visualization techniques.
**CO5:** Analyse trends using advanced data visualization techniques.

**Assessment Details**
**Continuous Internal Evaluation (CIE):**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| **SN** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | McGraw Hill Education | 2018 |
| 2 | Data Analytics: Principles, Tools and Practices | Dr. Gaurav Aroraa Chitra Lee Dr. Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: III**
**Course Name: Data Base Management System (DBMS)**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA302** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Introduction to Databases** **08 Hours**

| |
|---|
| Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module –2 Relational Model** **08 Hours**

| |
|---|
| Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations<br>Design: Relational Database Design using ER-to-Relational mapping.<br>SQL: SQL data definition and data types, specifying constraints in SQL, retrieval/queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 3 SQL: Advances Queries** **08 Hours**

| |
|---|
| More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.<br>Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 4 Normalization: Database Design Theory** **08 Hours**

| |
|---|
| Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 5 Transaction Processing** **08 Hours**

| |
|---|
| Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.<br>Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, |

| |
|---|
| Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Identify and define database objects using RDBMS tools.

CO2: Design database to solve business problems

CO3: Apply normalization techniques to normalize the database.

CO4: Apply normalization techniques to design the database to solve business problems

CO5: Demonstrate the use of concurrency and transaction in database.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| **SN** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | RamezElmasri and Shamkant B. Navathe | Pearson... | 7th Edition, 2017, |
| 2 | Database management systems | Ramakrishnan and Gehrke | McGraw Hill | 3rd Edition, 2014 |
| 3 | | | | |
| **Reference Books** | | | | |
| 1 | Database System Concepts | SilberschatzKorth and Sudharshan | McGraw Hill | 6th Edition, McGraw-Hill, 2013. |
| 2 | Database Principles Fundamentals of Design, Implementation and Management | Coronel, Morris, and Rob | Cengage Learning | 2012 |

**Semester: III**
**Course Name: Python Programming for Managers**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA303** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Introduction to Python** **08 Hours**

| |
|---|
| Variables, expressions and statements, Conditional execution& Iteration. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 2 Programming constructs/data structures** **08 Hours**

| |
|---|
| Data structures: Lists, Dictionaries, Tuples, Functions, Strings & Files, Pandas Data Structure. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 3 Pattern matching & regular expression** **08 Hours**

| |
|---|
| Pattern matching & regular expression: Character matching, extracting data, Combining searching and extracting, Escape character. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation. |

**Module – 4 Numpy & Pandas** **08 Hours**

| |
|---|
| Numpy: -Understanding data types in python, basics of NumPy arrays, computation on NumPy arrays: universal functions. Pandas: -Introducing to pandas data structures, essential functionality, summarizing and computing descriptive statistics, handling missing data, Pandas Data Frame Basics & Data structure. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 5 Classification & Prediction** **08 Hours**

| |
|---|
| Decision tree learning, Naïve Bayes Classifier, Text classification & Artificial Neural Network. Evaluation of models.<br>Clustering: K-means & K-medoids clustering, DBSCAN, Agglomerative Hierarchical Clustering, BIRCH, cluster evaluation. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Interpret classification and clustering techniques for handling large data in business objectives.

CO2: Illustrate looping, control statements in python.

CO3: Apply python data structures - lists, tuples, dictionaries and pandas for representing compound data in business applications.

CO4: Demonstrate the concept of pattern matching using regular expression in business objectives.

CO5: Apply the concept of numpy and pandas data structures in business objectives.

**Assessment Details**

Continuous Internal Evaluation (CIE):

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Data Mining -Concepts and Techniques | Jiawei Han, Micheline Kamber, Jian Pei | Morgan Kaufmann Publisher | 3rd Edition 2012 |
| 2 | “Python for Everybody: Exploring Data Using Python 3 | Charles R. Severance | Create Space Independent Publishing Platform, | 1st Edition 2016 |
| 3 | "Think Python: How to Think Like a Computer Scientist” | Allen B. Downey | Green Tea Press | 2nd Edition 2015 |

**Semester: III**
**Course Name: Data Warehousing**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA304** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 System Processes** **08 Hours**

| |
|---|
| Introduction, Typical process flow within a data warehouse, Extract & load process, Clean and Transform data, Backup & archive process, Query management process. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module –2 Process Architecture** **08 Hours**

| |
|---|
| Introduction, Load manager, Warehouse manager, Query Manager, Detailed information, Summary information, Meta data, Data marting. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 3 Design** **08 Hours**

| |
|---|
| Introduction, Star flake schemas, Identifying facts & dimensions, Designing fact tables, Designing the star flake schema, Query redirection, Multidimensional schemas, Horizontal partitioning, and Vertical partitioning. Why aggregate, What is an aggregation?, Designing summary tables. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 4 Data Marting** **08 Hours**

| |
|---|
| Introduction, When is a data mart appropriate, Designing data marts, Costs of data marting. Meta Data-Data transformation & load, Data management, Query generation, Metadata & tools. Hardware architecture –Process, Server hardware, Network hardware, Client hardware, Backup & Recovery –Definitions, Hardware, Software, Backup strategies, Testing the strategy, Disaster recovery. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 5 Capacity Planning** **08 Hours**

| |
|---|
| Introduction, Process, Estimating the load Tuning the data warehouse – Introduction, Assessing the performance, Tuning the data load, Tuning queries, Testing the data warehouse – Introduction, Developing the test plan, Testing backup recovery, Testing the operational environment, Testing the database, Testing the application, Logistics of the test. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Describe the functionality of various data warehousing component.

CO2: Discuss warehousing architecture and tools for systematically organizing large database and use their data to make strategic decisions.

CO3: Demonstrate the data marts repositories for large amount of transactional data for business applications.

CO4: Discover interesting patterns from large amounts of data for predictions and classification.

CO5: Develop a test plan for testing the various business applications.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Warehousing in the real world | Sam Anahory | Pearson education | Seventh edition 2003. |
| 2 | Data Warehousing, Data Mining & OLAP | Alex Berson, Stephen J Smith | TMH | |
| 3 | | | | |
| **Reference Books** | | | | |
| 1 | Data mining & Ware housing | I Singh | Khanna Publishing house. | |

**Semester: III**
**Course Name: Decision Support System**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA305** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of pedagogy | **40** | Total Marks | **100** |

**Module – 1 Decision Making and Computerized Support** **08 Hours**

| |
|---|
| Managerial decision making and information systems, the need for computerized decision support and the supporting technologies, the concept of decision support systems, executive information support systems, expert systems and intelligent agents, the evolution and attributes of computerized decision aids, decision making: introduction and definitions, systems, models, a preview of modeling process, the intelligence phase, the design phase. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module –2 Decision Making, Systems and Modeling** **08 Hours**

| |
|---|
| Decision making: the implementation phase, how decisions are supported, alternative decision-making models, personality types, gender, human cognition and decision styles. What is a DSS?, characteristics and capabilities of DSS, components of DSS, the data management subsystem, the model management subsystem, the user interface (dialog) subsystem, distinguishing DSS from management science and MIS, DSS classifications. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 3 Decision Support System Development** **08 Hours**

| |
|---|
| Introduction to DSS development, the traditional system development life cycle, alternate development methodologies, prototyping: the DSS development methodology, DSS technology levels and tools, DSS development tool selection, end user-developed DSS. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 4 Collaborative Computing Technologies: Group Support Systems** **08 Hours**

| |
|---|
| Group decision making, communication and collaboration, communication support, collaboration support: computer-supported cooperative work, Group Support Systems, Group Support Systems technologies, Group systems, the GSS meeting process, distance learning, creativity and idea generation, GSS and collaborative computing issues and research, enterprise systems: concepts and definitions, the evolution of executive and enterprise information systems, executives' roles and their information needs, characteristics and capabilities of executive support systems, comparing and integrating EIS and DSS. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Module – 5 Knowledge Management** **08 Hours**

| |
|---|
| Introduction to knowledge management, knowledge, organizational learning and organizational memory, knowledge management, the Chief knowledge Officer, knowledge management development, knowledge management methods, technologies and tools, knowledge success, knowledge management and artificial intelligence, electronic document management, knowledge engineering, difficulties in knowledge acquisition, methods of knowledge acquisition; an overview, interviews, tracking methods, observations and other manual methods. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Describe the fundamental concepts of Decision Support Systems.

CO2: Discuss the components of Decision Support Systems.

CO3: Demonstrate Decision Support Systems life cycle and tools used for development of Applications

CO4: Illustrate group support system technologies for developing collaborative applications to make appropriate decisions

CO5: Design integrated decision support systems for business applications.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| **SN** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Decision Support System and Intelligent systems | Efraim Turban, Jay E. Aronson | Pearson Education | 6th edition 2001. |
| 2 | Decision Support Systems, | Sprague R.H. Jr and H.J. Watson: | Prentice Hall | 4th Edition, 1996. |
| Reference Books | | | | |
| 1 | Decision Support Systems | R. Jayashankar | Tata McGraw Hill. | -- |
| 2 | Decision Support Systems | Janakiraman and Sarukesi | Prentice Hall of India, New Delhi | -- |

**Semester: III**
**Course Name: Digital Transformation**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA306** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 The Key Forces for Change** **08 Hours**

| |
|---|
| Relentless, accelerating change, Transformed competitive contexts, Transformed consumer contexts, Transformed company contexts, The agile context model, The key challenge: rates of change, How digital disrupts-The lifecycle of a technology, Why businesses get disrupted: the ambiguity zone, Defining digital. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module –2 Defining Digital Transformation** **08 Hours**

| |
|---|
| What digital transformation is NOT, What good looks like: a maturity model for change, The agile formula, Digital-native processes - Design thinking, Agile, Lean, The principles of agile business, Developing a learning culture, Learning to unlearn, Fixed and growth mindsets, Embedding reflection time. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 3 Agile Strategy and Planning** **08 Hours**

| |
|---|
| The key to good strategy, Emergent and deliberate strategy, The balance between vision and iteration, The customer-centric organization, ‘P’ is for Prioritization, Strategy as an ever, changing algorithm, Discovery-driven planning. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 4 Linking Strategy to Execution** **08 Hours**

| |
|---|
| The five questions, strategy and tactic trees, OKRs: bringing the team with you, Sprint working as a driver of change, Data-driven decision-making, technology as a barrier to change, technology as an enabler of change, Agile budgeting. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 5 The Transformation Journey** **08 Hours**

| |
|---|
| The five dimensions of change, Dimension one: personal, Dimension two: principles, Dimension three: process, Dimension four: practice, Dimension five: pace, Staying agile. |
| Teaching-Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Discuss the key forces for change in technology.
CO2: Illustrate the digital transformation process.
CO3: Develop the agile strategy for any business objectives
CO4: Analyse the linking strategy for decision making in business applications
CO5: Demonstrate the transformation dimensions for technological change

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Building the Agile Business Through Digital Transformation | NEIL PERKIN, PETER ABRAHAM | Kogan Page Limited | 2017 |

**Semester: III**
**Course Name: Basics of Logistics and Supply Chain Management**

| | | | |
|---|---|---|---|
| Course Code: | **22MBALS301** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Fundamental of Marketing Management.
- Basic knowledge of Transportation.
- Basics of Retail Management.

**Course objectives:**
1. To provide insights on the concept Supply Chain Management.
2. To familiarize the fundamentals of the Logistics.
3. To emphasis the concepts of Supply Chain Performance.
4. To educate the concepts of Warehousing.
5. To teach the concept of Export Logistics.

**Module – 1 Supply Chain Management** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Supply Chain Concepts: Objectives of Supply Chain; Decision Phases in Supply Chain; Process views of Supply Chain: Cycle View of Supply Chain Process, Push-Pull view of Supply Chain Process; Key Issues in SCM; Supply Chain Drivers, metrics and Obstacles, Supply Chain Strategies, Best Practices in SCM. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Drat & Present Best Practices of Supply Chain Management from top 5 corporates |

**Module – 2 Logistics** **08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Logistics: Evolution & Objectives of Logistics; Components and Functions of Logistics Management; Types of Logistics Management; Network Design, Network Design in the Supply Chain, Factors affecting Network Design Decisions; Order Processing and Fulfillment; Inventory Management; Material Handling, Pack and Labelling; Freight Transportation; Transportation –Functions, Costs and Mode; Containerization, Cross Docking, Hub & Spoke, Distributed Warehouses. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Prepare Proforma of Commercial Invoice, Dock Receipt, Bill of Lading with Imaginary details. |

**Module – 3 Supply Chain Performance** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Supply Chain Performance: Bullwhip Effect and Reduction, Reasons for measuring supply chain performance, Dimensions for measuring performance of supply chain management; Supply Chain Performance Measurement: & Techniques of Measuring Supply Chain Performance: SCOR Model, Balanced Scorecard, Activity Based Costing (ABC), Benchmarking, Logistics Scoreboard, Economic Value Analysis; Global Supply Chain: Driving forces of Global Supply Chain management, Important; Factors influencing, sourcing decision in Global SCM: benefit and key issues, and Trends.<br>08 Hours (RBT Levels:L2, L3, L4, L5) |

| |
|---|
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Drat & Present Tools of Performance Measurement |

**Module – 4 Warehousing & Supply Chain CRM          08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Warehousing: Concept and Types, importance/role, Strategic issues affecting warehousing, Warehouse operations, Pack and unit loads, Warehouse Design, Facility Location & Network Design, Outsourcing-Nature and Concept, Strategic Decision to Outsourcing, Third Party Logistics (3PL), Fourth Party Logistics (4PL), and Fifth Party Logistics (5PL); Supply Chain Processes –CRM, ISCM & SRM; IT Infrastructure Used for Supply Chain and CRM, Functional components of CRM; Green Supply Chain Management, Supply Chain Sustainability. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Present Overview of Major Warehousing Companies in India |

**Module – 5 International Logistics          08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Global Logistics and Environment, Methods and tools facilitating International Logistics, Challenges of Global Logistics, Integrated Supply Chain and Logistics, Logistics Industry in India. Sourcing Decisions in Global SCM -Logistics, Trends, Key Issues in Global Sourcing, Factors influencing Global sourcing. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Present Various Documents Required for International Logistics |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts of Supply Chain Management.
CO2: Analyze various functions of Logistics Management.
CO3: Evaluate tools of performance measurement.
CO4: Design appropriate warehousing strategies for an organization.
CO5: Construct the process of integrated supply chain management with international logistics prospective

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Supply Chain Management: Strategy, Planning and Operation | Chopra, Sunil, Meindl, Peter and Kalra, D. V | Pearson Education | Recent Edition |
| 2 | Supply Chain Management | Altekar, Rahul V. | PHI Learning Private Limited | Recent Edition |
| 3 | Supply Chain Management | Ballou, Ronald H. | Pearson Education | Recent Edition |
| 4. | Integrated Supply Chain and Logistics Management | Rajat K. Baisya | Sage | 2020 |
| 5 | Supply Chain Management- Text and Cases | Janat Shah | Pearson | Latest edition |
| 6 | Logistics & Distribution Management | Alan Rushton, Phil Croucher, Peter Bake | Kogan Page Limited | 5th EDITION ISBN 978 0 7494 6627 5 E-ISBN 978 0 7494 6628 2 |
| **Reference Books** | | | | |
| 1 | Supply Chain Management | Sahay, B.S. | Macmillan | Recent Edition |
| 2 | Business Logistics Management. | Ballou, R.H. | Prentice-Hall Inc. | Recent Edition |
| 3 | Logistical Management | Bowersox D.J., ClossD.J. | McGraw-Hill, 1996 | |

E-Resources:
https://www.tutorialspoint.com/supply_chain_management/supply_chain_management_tutorial.pdf
https://www.academia.edu/6547358/Logistics_Concept_Evolution_Objectives_and_Elements
https://egyankosh.ac.in/bitstream/123456789/11527/1/Unit-13.pdf
https://newizze.com/how-to-build-a-crm-for-warehouse-management/
https://www.dripcapital.com/en-in/resources/blog/export-logistics-process
https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/149-The-Handbook-of-Logistics-and-Distribution-Management-Understanding-the-Supply-Chain-Alan-Rushton-Phil-Croucher-Peter-Baker-Edisi-1-2014.pdf

**Semester: III**
**Course Name: Warehouse Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS302** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**

- Students should have basic concepts of logistics & supply chain.
- Fundamentals of Marketing
- Basics of Distribution Channel Management.

**Course objectives:**

1. To provide basic knowledge about Warehouse Management.
2. To provide an insight on Warehouse process and E-commerce application used in warehousing.
3. To impart know-how required to operate an efficient and cost effective Storage Management system.
4. To teach the usage of Warehouse Functions and Design.
5. Develop an understanding towards – strategic, tactical and operations related to Material Handling and Warehouse safety.

**Module – 1 Introduction to Warehousing Concepts 06Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Role of warehouse; Need for warehousing; Types of warehouse; Warehouse location Supply chain trends affecting warehouse; Warehouse functions, Role of warehouse manager. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Identify different types of Warehouse functions and roles. |

**Module – 2 Warehouse Process 06Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Warehouse processes: Pre-receipt; Receiving; Put-away: Preparation, Offloading, Checking; Storage: Stock management; Stock or Inventory counting-Perpetual inventory counts; Security; Picking: Pick preparation, Pick area layout, Picking strategies and equipment, Order picking methods; & Packing, De-kitting/kitting & Casing: Dispatching: Cross-docking; Replenishment to dispatch; Value adding services; Indirect activities; Returns processing. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Pick a company of choice and prepare a detailed report on warehouse process. |

**Module – 3 Inventory Management 06 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Inventory Management Concept, Various costs associated with inventory, Functions of Inventory; Types of Inventory Management: Just-in-time management (JIT), Economic Order Quantity (EOQ), Days sales of inventory (DSI), Material requirements planning (MRP); Classification of Inventory; Types of Inventory, Alternative approach for classification of inventories; Methods of Controlling Stock Levels; Buffer stock, lead time reduction, reorder point/re-order level fixation; Always Better Control (ABC) Inventory system; Components of inventory decisions, inventory cost management, business response to stock out, replenishment of inventory. |
| Teaching-Learning Process: |

| |
|---|
| Pedagogy: Chalk and talk method, Power point presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are Studying the role of technology that helps warehouse managers in Inventory Management decisions. |

**Module – 4 Warehouse Functions and Design 10 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Functions of Warehouse: Introduction, Receiving, prepacking, transporting to the appropriate storing place, storage, order picking, Pack or pricing, sorting, consolidation and shipping. Roles and responsibilities of manager, Benefits of Warehousing: Economics benefits, Operational benefits of warehousing; & Consolidation and break bulk, cross docking, processing and stock piling stock spotting, assortment, mixing; Warehouse Location and Design: Introduction, Site analysis, Product mix consideration, design criteria, Storage plan, Aisle width decisions. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, Power point presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Create and design a warehousing information system that encompasses the competencies in storage and warehouse management. |

**Module – 5 Material Handling and Warehouse safety 10 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Material handling; Product movement concept Costs: product load activity, dispatch activity, unloads activity; Warehouse equipment; Forklift trucks, vehicles, warehouse equipment legislation. Automation of warehousing, Warehouse Control Devices: Impact of the computer technology automatic identification; Pack-Pallet-Stretch wraps, Cartons Issues and trends in product transport; Product Labeling; Health and Safety Risk assessment: layout and design, fire safety, slips and trips, manual handling, working at height, Warehouse safety check list Warehouse Environment Energy production, product waste & waste disposal, hazardous waste; Sustainable warehouse Management. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk method, YouTube videos, Power point presentations<br>Skill Enrichment Exercises: Students are asked to identify the warehouse security issues and strategies to solve the issues. |

**Course Outcomes:**

At the end of the course the student will be able to:

1. Apply and understand the role of the warehouse and warehouse manager in today's supply chain
2. Analyze the various warehouse processes, strategies, and methods for appropriate decisions.
3. Evaluate the various storage inventory management methods.
4. Design the specific warehouse with determining the functions.
5. Develop and enhance effective inventory control, material handling, and warehouse safety techniques.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Warehouse Management: A Complete Guide to Improve Efficiency and Minimizing Cost in the Modern Warehouse. | Gwynne Richards | Kegan page limited | Latest 2016 |
| 2 | A Supply Chain Logistics Program for Warehouse Management | David E. Mulchy & Joachim Sidon (2008) | Auerbachian Publications | 2008 |
| **Reference Books** | | | | |
| 1 | Supply Chain Logistics Management | Bowersox, D.J., Closs, D.J., Cooper, M.B., & Bowersox, J.C. | McGraw Hill/Irwin. | 4e, 2013 |
| 2 | The Introduction to Materials Management. | Arnold, J.R., Chapman, S.N | Prentice-Hall | 7e 2012 |
| 3 | Managing Supply Chains: A Logistics Approach. | Coyle, J.J., Jr. Langley, C.J., Novack, R.A, & Gibson, B.J | McGraw-Hill. | 9e, 2013 |

**E-Resources:**

1. https://www.researchgate.net/publication/339313759_Design_and_Implement_E-Warehouses_Management_System_for_Universities_in_Developing_Countries
2. https://golocad.com/warehousing/warehouse-management/
3. https://www.oracle.com/in/scm/logistics/warehouse-management/
4. https://6river.com/warehouse-management-best-practices/
5. https://www.softwareadvice.com/scm/warehouse-management-system-comparison/

**Semester: III**
**Course Name: Purchasing and Strategic Sourcing**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS303** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
Logistics and supply chain management theory, models and methods of logistics.

**Course objectives:**
1. To explore the fundamental concepts of Purchase Management.
2. To impart the importance of Purchasing and Sourcing management in modern day business, and understand the key role the supply function plays.
3. To educate the importance of selection of vendors
4. To understand the key activities/process in negotiation techniques.
5. To teach contract framework in supply management.

**Module – 1 Purchasing Operations and Structure** **06 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Importance and Objectives of Purchasing; The purchasing and sourcing process: Types of purchases Purchasing policy and procedures: Centralized and decentralized purchasing; Strategic sourcing: make-or-buy decisions; Principles and steps; Procurement Strategies; Types and importance, E-Procurement; Management structure, roles and responsibilities in purchasing / sourcing. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are asked to prepare a detailed report on purchasing system and process of any two companies. |

**Module – 2 Supply Management Integration and Strategic Sourcing**
**10 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Supply Integration: Its importance, Internal integration, External integration; Purchasing position within the organizational structure; Essential Elements of an Effective Supplier Integration; Barriers of supply integration and Things to Avoid in Supplier Integration; The critical role of cross functional scouring teams in integrating supplies and suppliers and to develop new products and services; Supply management and commodity strategy development; Aligning supply management and enterprise objectives; Category strategy management; Types of supplier management strategies; Evolving sourcing strategies. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: To conduct an interview with Purchasing manager and collect the data on Supply chain integration and Strategic sourcing. |

**Module – 3 Supplier Evaluation and Selection** **10 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Supplier Evaluation and Selection Process; Need for Supplier Selection; Identifying Key Sourcing Requirements; Determining Sourcing Strategy, Identifying Potential Supply Sources and Sourcing Alternatives; Limiting Suppliers in Selection Pool; Determining the Method of Supplier Evaluation and Selection; Invitations, Auctions and Tenders; Comparing suppliers based on cost, quality, performance; |

| |
|---|
| Selecting Suppliers Negotiating and Reaching Agreement. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, Power point presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Comparison of selection of Industrial products any two suppliers. |

**Module – 4 Negotiations** **06 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Definition, Negotiation Framework, Stages of negotiations; Identify or Anticipate a Purchase Requirement, Determine If Negotiation Is Required, Setting objectives for negotiations; Plan for the Negotiation: Develop Specific Objectives, Analyze Each Party's Strengths and Weaknesses, Gather Relevant Information, Recognize Your Counterpart's Needs, Identify Facts and Issues, Establish a Position on Each Issue; Develop the Negotiation Strategy and Accompanying, Tactics, Brief key Personnel, Practice the Negotiation Concessions; Conduct the Negotiation, and Execute the Agreement; Types of negotiations; data-driven negotiation approach; Win-Win Negotiation. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, Power point presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: To conduct student role play on Negotiation Skills. |

**Module – 5 Contract Management** **08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Introduction, Elements of a Contract; Types of Contracts: Fixed-Price Contracts, Cost-Based Contracts, Considerations when Selecting Contract; Types Long-Term Contracts in Alliances and Partnerships. Benefits of Long-Term Contracts Risks of Long-Term Contracts; Contingency Elements of Long-Term Contracts; Consulting Contracts, Construction Contracts, Other Types of Contracts Settling Contractual Disputes, Arbitration Other Forms of Conflict Resolution; How to Write a Contract. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk method, YouTube videos, Power point presentations<br>Skill Enrichment Exercises: Students are assignment for drafting the important contact formats |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Applying the basics of purchasing operations and purchasing policies in business

CO2: Analyze the Methods Supply Integration with Sourcing.

CO3: Evaluate various Supplier and Selection process for appropriate business situation

CO4: Design the negotiation Process and Procedure for appropriate business situation.

CO5: Comprehend he most appropriate contract techniques to be used when dealing the potential suppliers

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | In Coterms Exports Coartind and Pricing with Practical Guide to in Co-Terms | Parasram | Jain Book | 1st Edition, 6th Edition, 2010. |
| 2 | Purchasing and Supply Management. Additional cases and articles will be assigned | Johnson, Leenders, and Flynn | McGraw Hill. 6 | 14th Edition |
| **Reference Books** | | | | |
| 1 | Global Operations &Logistics: Text & Cases-Dornier | John Wiley | Pearson Education | 2nd Edition, 2013 |
| 2 | Designing & Managing Supply Chain-Concepts, Strategies | David Simchi-Levi | Tata McGraw Hill | 8th Edition, 2000 |

**E-Resources:**

1. https://www.techtarget.com/searcherp/definition/strategic-sourcing
2. https://www.researchgate.net/publication/273286559_A_contextual_analysis_of_the_impact_of_strategic_sourcing_and_E-Procurement_on_performance
3. https://aavenir.com/what-is-strategic-sourcing/
4. https://merlinsourcing.com/
5. https://www.emerald.com/insight/publication/issn/2398-5364
6. http://www.mim.ac.mw/books/Purchasing%20And%20Supply%20Chain%20Management%204th%20edition.pdf

**Semester: III**
**Course Name: Inventory Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS304** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Fundamentals of Inventory Management
- Understanding towards Inventory Management Process.
- Different types of Inventory Management.

**Course objectives:**
1. To introduce students to the key terms associated with Inventory Management.
2. To learn about various types of inventory, and inventory costs.
3. To understand about Economic Order Quantity and stock levels under various conditions.
4. To familiarize with various methods of inventory control.
5. To acquaint about factors influencing Make or Buy decisions and solve problems based on ABC classification of inventory.

**Module – 1: Basics of Inventory Management** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Inventory concepts, Pressures for Low Inventory, Pressures for High Inventory, Role of inventory in Operations, Types of inventory – seasonal, decoupling, cyclic, pipeline, Safety stock. Inventory costs – carrying costs, ordering costs, shortage costs. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to discuss on importance of inventory management. |

**Module – 2: Inventory Control systems** **08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Need for inventory Control system, Meaning of inventory control system, Importance and methods of inventory control, Continuous Review (Q) systems, Periodic Review (P) systems, Issues in the P and Q systems of inventory control. ABC Classification system, FNS, Safety stock, JIT, Implementation Process and Benefits. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students must under a mini project and submit a report on company's inventory control |

**Module – 3: Economic Order Quantity Models** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| The Basic EOQ Model, Production Quantity Model, Computer Solution of EOQ model, Quantity Discounts, Reorder Point, Safety Stocks and Replenishment Policy on Safety Stock, Service Level, Reorder point with variable demand, Order quantity for periodic inventory system, Order quantity with variable demand. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students asked to list various models of EOQ |

**Module – 4: Just-In-Time** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Principles of just-in-time, Core logic of JIT, Main features for stocks, Achieving just-in-time operations, and Other effects of JIT, Benefits and disadvantages of JIT, Comparison with other methods of inventory management. KANBAN as a control tool. Vendor managed inventory. Optimum Level of Product Availability and Methods in Determining Product Availability. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Case study on Just in time of Toyota |

**Module – 5: Make or Buy Decisions** **08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Introduction, Make Versus Buy: The Strategic Approach Identifying Core Processes, Factors influencing Make Or Buy Decisions-cost, The Business Process Route, The Product Architecture Route, Versus Hierarchy, Economies of Scale Agency Cost, Transaction Cost, Incomplete Contracts, Integrative Framework of Market Versus Hierarchy The Make-Versus-Buy Continuum, |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to discuss on Logistics Management and Procurement. |

**Course Outcomes:**

The student should be able to:

CO1: Assess the key terms associated with Inventory Management.
CO2: Analyze various types of inventory, and inventory costs.
CO3: Evaluate the Economic Order Quantity and stock levels under various conditions.
CO4: Design the various methods of inventory control.
CO5: Comprehend factors influencing Make or Buy decisions and solve problems based on ABC classification of inventory.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks Recommended** | | | | |
| 1 | Operations Management: Theory and Practice | B Mahadevan | Pearson | Latest edition |
| 2 | Operations Management-Process and Value Chains | Krajewski, Ritzman, Malhotra, | Pearson. | |
| 3 | Operations Management: Quality and Competitiveness in a Global Environment | Russell and Taylor | Wiley India. | |
| 4 | Supply Chain Management- Text and Cases | Janat Shah | Pearson | Latest edition |
| **Reference books** | | | | |
| 1 | Essentials of Inventory Management | Max Muller | JAICO Publishing | |
| 2 | Just-in-Time Manufacturing, | Korgaonker | Macmillan | |
| 3 | Inventory Control and Management | Donald Waters | Wiley Student Edition. | |

## E-Resources:

https://www.tradegecko.com › eBooks › inventory-man.
https://www.researchgate.net/publication/311004553_Inventory_Control_Systems_Model_for_Strategic_Capacity_Acquisition
https://www.strategyand.pwc.com/gx/en/insights/2002-2013/make-or-buy/strategyand-make-or-buy-sound-decision-making.pdf
https://www.amazon.in › Inventory-Management-Retail
https://www.researchgate.net/publication/341965168_Just_In_Time_JIT_Production_and_Supply_Chain_Management
https://pub.abuad.edu.ng/Open_Access_Research_Projects_of_Universities_-_Batch_2/COMPUTER%20ENGINEERING/DESIGN_AND_IMPLEMENTATION_OF_AN_AUTOMATED_INVENTORY_CONTROL_SYSTEM_FOR_A_MANUFACTURING_ORGANIZATION.pdf
https://www.clear.in/s/inventory-control

**Semester: III**
**Course Name: Supply Chain Management and Risk Modeling**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS305** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Fundamentals of Supply Chain Management.
- Understanding towards role Risk modeling.
- Different Supply chain models.

**Course objectives:**
1. To introduce students to the supply chain and its nature
2. To learn various optimization models
3. To understand optimization of various strategies
4. To familiarize about the risks in supply chain
5. To acquaint about types of operational risks

**Module – 1 Introduction of Supply Chain Management 08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Definition of Supply Chain Management - Integrated Planning and Models – Supply Chain Models & modeling Systems – Supply Chain Decision Databases – Data Aggressions, Facility Data, Transportation Network data, Supplier Data – Integrating Supply Chain & Demand Management, Price & location Sensitive Revenue Curves. Supply Chain Performance and Control-Throughput Dollar Days (TDD) and Inventory Dollar Days (IDD). |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to list out the core components of supply chain management. |

**Module – 2 Fundamentals of Optimization Models 08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Linear programming Modeling –Resource Allocation Model, Infeasible & Unbounded Models, Multi period Resource Allocation Model, Network Models., Properties of Linear Programming Models, Dual Linear Programming Model, Parametric 7Sensitivity Analysis., Spread sheet and Multiple Objective, unified Optimization, Stochastic Programming. Mixed Integer Programming Modeling, Distribution Centre Location Models, Supply Chain Network Optimization Models, Optimization Software. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to submit a report on application areas of Optimization Models. |

**Module – 3 Supply Chain Models and its Strategies 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Optimization Models for Competitive Analysis, Scenario Planning, Decision trees & Stochastic Programming, Supply Chain Strategies for managing Product Variety. Simulation Models & Systems – Deterministic Simulation, Monte Carlo Simulation, Simulation Software, Simulation Vs Optimization, Inventory Theory Models –Deterministic Models, Probabilistic Models, ABC Classification. External Integration Strategies in Supply Chain. Supply Chain Maturity Reference Model. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Case Study of John Deere on supply chain cost reduction. |

**Module – 4 Risk and Management 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Risk in the Supply Chain, Features of Risk, Decisions & Risk, Structure of Decisions, Decisions with uncertainty, Risk, ignorance, Managing Risk Structure of a Supply Chain, Increasing Risk, Trends in Supply Chain Management. Integration of supply Chains, Cost Reduction, Agile logistics, E – Business, Globalization, Outsourcing, Changing practices in Logistics. Approaches to Risk Management. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Case study on changing practices in logistics at Noatum Logistics |

**Module – 5: Identifying Risks 08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Types of Risks, Tools for analyzing past events, Operations, Problems with Risk Identification, Measuring Risk, Consequences of Risk, responding to Risk – Alternative responses, Defining Options, Choosing the best response, Implementation & Activation, A Network view of Risk – Shared Risks, achieving an Integrated approach, Analyzing & responding to risks. Prising and Revenue Management in Supply Chain. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to discuss various types of risks. |

**Course Outcomes:**

The student should be able to:

CO1: Assess supply chain and its nature and apply the appropriate integration process.
CO2: Analyze various optimization models for the Logistics &Supply Chain Management.
CO3: Evaluate the optimization of various strategies.
CO4: Comprehend the various risks associated in Supply Chain Management.
CO5: Communicate the types of operational risks in Supply Chain Management.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Eachfullquestionisfor20marks.
- EachfullquestionwillhavesubquestioncoveringallthetopicsunderaModule.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100percenttheoryintheSEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks Recommended** | | | | |
| 1 | Trent Supply Chain Risk Management: An Emerging Discipline | Gregory L. Schlegel, Robert J | (Resource Management) Hardcover – Import | 3 Nov 2014. |
| 2 | Supply Chain Risk: A Handbook of Assessment, Management | George A. Zsidisin and Bob Ritchie | International Series in Operations Research & Management Science | ) Hardcover – Import, 20th October 2008 |
| **Reference books** | | | | |
| 1 | Supply Chain Risk Management, | Donald Waters | Published by the Chartered Institute of Logistics & Transport, U.K | 2007 ISBN-13: 978-0-7494-4854-7 ISBN-10: 0-7494-4854-7 |
| 2 | Modeling the Supply Chain, | Jeremy F.Shapiro, | Duxbury. | |

**E-Resources:**

https://www.researchgate.net/publication/282845695_Risk_in_Supply_Chain_Management_and_its_solution

https://www.researchgate.net/publication/281119238_Supply_chain_strategies_for_the_fast_moving_industries

3. http://ebooks.lpude.in › management › risks in models of supply chain_

https://www.seas.upenn.edu/~cis515/linalg-II.pdf

https://core.ac.uk/download/pdf/221517118.pdf

**Semester: III**
**Course Name: E-Logistics**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS306** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Fundamentals of logistics
- Understanding towards Supply chain of various industry.
- Differences among types of logistics

**Course objectives:**
1. To introduce students to e-logistics and its importance
2. To learn about the method of e-logistics documentation
3. To understand e-logistics tracking.
4. To familiarize about e-procurement and CRM
5. To acquaint about types e-logistics

**Module – 1: Introduction to E-logistics** **08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Definition of logistics management, Supply Chain Management for E-Commerce and its Challenges and Solutions, forward logistics – Reverse logistics – Logistics renovation toward E-logistics – importance of E-logistics – New trends and technology in logistics. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to choose a Manufacturing unit and mention the logistics process of that unit. |

**Module – 2: E-logistics method of documentation** **08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Electronic data interchange – Personal computer – Enterprise resource planning systems – The internet, intranets and extranets – The world wide web – Web-enabled relational databases, data warehouses and data marts – Decision support systems. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked discuss about ERP and its applications. |

**Module – 3: ASNs – Tracking systems** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Satellite global positioning systems (GPS) and geographic information systems (GIS) – Bar-coding and scanning – Electronic signature technology – Wireless technology – Radio frequency identification (RFID).IT and Its Role in SCM. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to prepare a report on the Pros-Cons of GPS/wireless technology. |

**Module – 4: Electronic procurement (e-procurement) 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Transport and delivery management – Pack and order management – Inventory and warehousing – Application architecture of Customer relationship management (CRM) – E-business logistics and its benefits. IT enabled Supply Chain Transformation. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Case study of Starbucks on Supply chain |

**Module – 5: Forward E-logistics 08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Reverse E-logistics – Challenges of E-logistics – environmental issues – e-business strategy – Application for E-logistics – Business to business – Business to consumers – Exception based status alert – Transportation documentation. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars.<br>Skill Enrichment Exercise: Students are asked to discuss about the challenges in e-logistics. |

**Course Outcomes:**

The student should be able to:

CO1: Assess the Importance concepts of E-logistics and its applications

CO2: Analyze the different method of e-logistics documentation

CO3: Evaluate the importance of e-logistics tracking.

CO4: Comprehend the different models of e-procurement and CRM.

CO5: Communicate the appropriate uses of reverse E-logistics.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Realizing e-business with application service providers | Louis Columbus | LWC publication. | |
| 2 | Selling in Manufacturing and Logistics | Mike Jones, Ken Guest | Udible Publishers | |
| **Reference Books** | | | | |
| 1 | E-business: Key Issues, Applications and Technologies | B Stanford | Ohmsha publication. | |
| 2 | E-Logistics | Wang Yingli | Kogan Page Ltd | |

## E-Resources

https://www.pdfdrive.com › international-marketing-e3https://youtu.be/9x6yOwR7lSk
http://ebooks.lpude.in › management › mba › term_
https://www.pearson.com › 9781488611162
https://www.researchgate.net/publication/330693494_E-LOGISTICS_-_ASPECTS_OF_FUNCTIONING
https://www.oecd.org/mena/governance/36238198.pdf

**Semester: III**
**Course Name: Financial Markets & Services**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM301** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Knowledge of the basic concepts of Financial Markets
- Knowledge of capital markets & money markets.
- Good Communication skills
- Decision-making skills

**Module-1 Overview of Indian Financial System** **08 Hours**

| |
|---|
| Financial system – An overview, Indian financial system, Global financial system, Financial services – An overview, Financial Institutions, Clearing Corporation of India Limited (CCIL), Credit Information Bureau of India Limited (CIBIL), Discount and Finance House of India Limited (DFHI), Over-the-Counter Exchange of India Limited (OTCEI), National Securities Depository Limited (NSDL), National Housing Bank (NHB), Demat account. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the structure of Indian Financial System |

**Module – 2 Capital Markets** **08 Hours**

| |
|---|
| Primary Capital markets – An overview, Capital market instruments, Capital market reforms, New issues market – A Conceptual framework and new issues market evaluation, Prospectus, Global depository receipts<br>Secondary Capital Markets: Stock exchange – An overview, Stock exchange trading. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the working of Stock Exchange |

**Module – 3 Money Markets** **08 Hours**

| |
|---|
| Money market, Call money market, Commercial paper market, Commercial bill market, Certificate of deposit (CD), Treasury bills, Govt. Securities market. Role and responsibilities of RBI with respect to money market, RBI monetary policy and its relevance to money market. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercises: Study the components of Indian Money Market |

**Module – 4 Asset/Fund Based Financial Services** **08 Hours**

| |
|---|
| Lease Finance- Conceptual and Regulatory Framework, Classification and Financial leasing, Hire Purchase and Consumer Credit, Factoring and Forfeiting, Housing finance, Venture capital financing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the various types of fund based financial services |

**Module – 5 Fee-based / Advisory services** **08 Hours**

| |
|---|
| Investment Banking – Introduction, Functions and activities of Merchant bankers, Lead Managers, underwriting, bankers to an issue, debenture trustees, portfolio managers. Challenges faced by investment bankers. Stock broking, Custodial Services, Depository system, Credit rating – Role of agencies, Process, regulations. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the various types of fee based financial services |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concept of Indian Financial System and its significance.
CO2: Analyze the capital markets and their instruments.
CO3: Evaluate the role of money markets and the ethical dimensions in the financial markets.
CO4: Design the various types of fund based financial services.
CO5: Communicate the various types of advisory services in Indian Financial Markets.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Financial Markets, Institutions and Financial Services | Clifford Gomez | Prentice Hall India Pvt. Ltd | 1st Edition, 2008 |
| 2 | Management of Banking and Financial Services | Justin Paul and Padmalatha Suresh | Pearson | 2012 |
| 3 | Indian Financial System | Bharati V Pathak | Pearson Publications | 5th edition, 2018 |
| Reference Books | | | | |
| 1 | Financial Services | M.Y. Khan | McGraw Hill | 10th Edition |
| 2 | Financial Services and System | Gurusamy | Cengage | 2012 |

**Semester: III**
**Course Name: Investment Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM302** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamental of economics and mathematics
- Basics of finance
- Understanding of Saving and Investment

**Module – 1 Introduction to Investment** **08 Hours**

| |
|---|
| Concept of Investment, Objective, characteristics .Investment Versus Speculation. Various Investment avenues .Sources of Investment information. Financial Versus Non-Financial Investments. Security versus Non-Security form of Investment. Investment Management Process.<br><br>Various Types of Security Markets and their Function. Role of SEBI with regard to Secondary Markets. The Role and Functions of Various Players and Agencies in the Secondary Market & Primary Market. Mechanics of Security Trading. Strategies of the Great Masters: The Timeless Wisdom. (Only Theory) |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Visit SBI and BSE/NSE website and identify various asset class |

**Module – 2 Return and Risk Concepts** **08 Hours**

| |
|---|
| Concept, Types of Risk- Systematic risk & Unsystematic Risk, Risk-Return Relationship, Concept of diversifiable risk and non-diversifiable risk. Types of return-Growth & Income. Calculation of Return and Risk of Individual Security & Portfolio of stocks (group of 2 & 3 assets). |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Use data analysis tool pack in excel to measure risk and return |

**Module – 3 Security Analysis** **08 Hours**

| |
|---|
| Security Analysis<br>Fundamental analysis (EIC analysis), Technical Analysis (Charts, Indicators, Patterns). Market Efficiency theory , Concept of Behavioral Finance |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Use capitaline database for financial statement analysis |

**Module – 4 Valuation of Securities** **08 Hours**

| |
|---|
| Bond Valuation, Bond Duration, Bond Management Strategies. Preference Shares-Valuation.<br>Equity Shares- Concept, Valuation, Dividend Valuation Models .P/E Ratio valuation model.<br>CAPM (Assumptions, equation, CML Vs SML, Application of CML, SML and Beta estimations).Arbitrage Pricing Model: Equation, Assumption. |
| Teaching-Learning Process: |
| Pedagogy: Excel based calculation, websites of NSE/BSE<br>Skill Enrichment Exercise: Estimate regression analysis and correlation using Excel |

**Module – 5 Portfolio Theory** **08 Hours**

| |
|---|
| Markowitz Model: Diversification, Portfolio Return, Portfolio Risk, Efficient Frontier. Sharpe's Single Index Model .Sharpe's Optimum Portfolio Construction.<br>Portfolio Revision Strategies – Objectives, Performance plans. Portfolio performance Evaluation: Measures of portfolio performance (Theory & Problems). Portfolio Management Strategies: Active and Passive Portfolio Management strategy. Portfolio Revision: |
| Teaching-Learning Process: |
| Pedagogy: Case study discussion, articles from Magazine and research related.<br>Skill Enrichment Exercise: Use www.amfiindia.com website for mutual fund evaluation |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Assess the capital market and various instruments for investment.
CO2: Evaluate risk & return associated with Investments.
CO3: Analyze Company, Industry and Economy framework for Investment management.
CO4: Evaluate equity and dividend valuation.
CO5: Apply the theories, tools and techniques of portfolio management.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 % Theory and 60 % Numerical in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Investment Analysis and Portfolio Management | Prasanna Chandra | McGraw Hill | 6/e and 2014 |
| 2 | Security Analysis & Portfolio Management | J Kevin | Tata McGraw Hill Education | 2014 |
| 3 | Analysis of Investments & Management | Reilly & Brown | Cengage Publications, | 10/e, 2017 |
| **Reference Books** | | | | |
| 1 | Investments | ZviBodie, Kane, Marcus & Mohanty | Tata McGraw Hill Education | 8/e, 2010 |
| 2 | Security Analysis & Portfolio Management | Punithavathy Pandian | Vikas Publications | 2/e, 2018 |
| 3 | The Intelligent Investor | Benjamin Graham | Harper Business | 2013 |

**Semester: III**
**Course Name: Direct Taxation**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM303** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of Annual Budget.
- Fundamentals of Macro Economics.
- Awareness of Government policies

**Module – 1 Tax Fundamentals** **08 Hours**

| |
|---|
| Basic Concepts and definitions, Assesse, person, previous year, assessment year, Basis of charge and scope of total income, Residential Status and Incidence of Tax (Problems on Residential Status of Individual Assesse) |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study, etc.,<br>Skill Enrichment Exercise: Analyze the recent annual budget and tax rates |

**Module – 2 Incomes from Salaries & HP** **08 Hours**

| |
|---|
| Meaning of Salary, Allowances, Valuation & Taxability of Perquisites, Death cum Retirement benefits, Deductions against Salary.<br>Income from House Property : Annual Value, Deductions U/S 24: Interest on loan; Standard Deduction; SOP; Let out Property (Problems on salary & HP Income). |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study, etc.,<br>Skill Enrichment Exercise: Apply the various deductions of salary and HP to determine the taxable income |

**Module – 3 Income from Business /Profession** **08 Hours**

| |
|---|
| Income under the head Profit and Gains of Business or Professions and its computation- Basic method of Accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation. (Problems on computation of Income from business / Profession of Individual Assesse and Depreciation). |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study, etc.,<br>Skill Enrichment Exercise: Asses the Company's Financial statements to understand the Depreciation allowance |

**Module - 4 Income from Capital Gain & Other sources** **08 Hours**

| |
|---|
| Income under Capital Gain, basis of charge, transfer of capital asset, inclusion & exclusion from Capital Asset, Capital Gain, Computation of Capital Gain, Deductions from capital gains. (Problems on computation of Income from capital gain).<br>Income from Other Sources: Only theory |
| Teaching-Learning Process: |

| |
|---|
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Explore the calculations of income from lottery and other residual incomes and TDS thereby |

**Module – 5 Computation of Total Income** **08 Hours**

| |
|---|
| Permissible deductions under section 80C to 80U; Setoff and carry forward of losses.<br>Computation of tax liability of Individuals.<br>(Problems on Computation of taxable Income and tax liability of Individuals). |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Determine the Taxable income and tax liability using individual details of incomes. |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Apply theoretical knowledge of Income Tax for determination of Residential Status.
CO2: Analyze the Income from salary and HP of individual Assesse.
CO3: Evaluation of Income from PGBP
CO4: Communicate the Capital Gain and Other Sources Income Statement
CO5: Prepare the statement of Total Income of Individual Assesse

**Assessment Details**

**CIE:**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Direct Taxes Law and practice | Vinod Singhania and Kapil Singhania | Taxman Publications | Latest Edition |
| 2 | Income Tax including Tax planning & Management | Dr. H.C. Mehrotra and Dr. S.P Goyal | Sahithya Bhawan Publication | Latest Edition |
| 3 | Income Tax | Dr. G B Baligar<br>Prof. S L Patil | Ashok Prakashan | 2023-24 |
| Reference Books | | | | |
| 1 | Students Handbook on Taxation | T N Manoharan | Snow White Publications Pvt. Ltd | Latest Edition |
| 2 | Income Tax Law & Practice | B.B.Lal & N. Vashisht | Pearson | Latest Edition |
| 3 | Problems & Solutions in income tax | H.C.Mehrotra & S.P.Goyal | Sahithya Bhavan Publications | Latest Edition |

**Semester: III**
**Course Name: Advanced Financial Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM304** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Knowledge of financial environment so as to allow a proper assessment the circumstances encountered by the firm.
- Knowledge of tools which accurately determine the financial condition of the firm
- Knowledge of funding avenues available to the firm

**Module – 1: Capital Structure Decisions** **08 Hours**

| |
|---|
| Capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, Traditional approach. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. (Theory and Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study capital structure of companies and its impact on EPS |

**Module – 2 Dividend Policy** **08 Hours**

| |
|---|
| Dividend policy – Theories of dividend policy: relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. (Theory and Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study dividend policy of companies and its impact on shareholders' wealth |

**Module – 3 Working Capital Management Policy** **08 Hours**

| |
|---|
| Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverage. (Theory) |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the working capital financing provided by a Bank and submit the report on the same |

**Module – 4 Inventory Management** **08 Hours**

| |
|---|
| Inventory Management: Determinations of inventory control levels: ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis. (Theory and problems) |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the Inventory management of Manufacturing Companies |

**Module – 5 Cash Management** **08 Hours**

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|---|
| Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr model, Strategies for managing surplus fund. (Theory and Problems) |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise:• Study the annual report of any two companies and prepare a cash budget for next year |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the capital structure theories for decision making
CO2: Analyze dividend policy of the firm
CO3: Evaluate the working capital in an organization
CO4: Design the techniques of Inventory Management
CO5: Develop the optimal cash management model

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Financial Management | M.Y. Khan & P.K. Jain | TMH | 6/e, 2011 |
| 2 | Financial Management | Prasanna Chandra | TMH | 8/e, 2011 |
| 3 | Corporate Finance-Text and Cases | Vishwanath S.R. | Sage Publishing | 3/e, 2019 |
| **Reference Books** | | | | |
| 1 | Financial Management & Policy | Vanhorne | Pearson | 12/e, |
| 2 | Financial Planning: Theory and Practice | Sid Mittra, Shailendra Kumar Rai, Anandi P Sahu& Harry Starn, Jr. | Sage Publishing | 1/e, 2015 |
| 3 | Financial Management-A | Rajesh Kothari | Sage Publishing | 2/e, 2017 |

**Semester: III**
**Course Name: Mergers & Acquisitions and Business Valuation**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM305** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamental of Business Environment
- Basics of Strategic management.
- Understanding of financing activities

**Module – 1 M & A** **08 Hours**

| |
|---|
| Introduction -Types of mergers–Merger Motives, - Buy side M & A, - Financing Options for buyer, -Sell-side M & A, -Factoring affecting Sell-Side M & A, -Sell Side Process. Meaning and types of acquisition/takeovers (Friendly and Hostile takeovers), -Anti-takeover strategies. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Case Study on Reliance Industries Ltd: Growth Through M & A Tool |

**Module – 2 Financing Options** **08 Hours**

| |
|---|
| Financing Aspects of M & A: Introduction, Normal equity, Differential Voting Equity, Preference Shares, Debt Financing, Retained Earnings, Euro Bonds, Foreign Bonds, Depository Receipts, External Commercial Borrowings (ECBs), Equipment Financing , Leasing and Hire Purchase, Types of Leasing, Advantage. (Theory only ) |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Case study on Tata Steel Corus Refinances of Loan |

**Module – 3 Financial Evaluation of M & A** **08 Hours**

| |
|---|
| Merger as a capital budgeting-Business valuation approaches-asset based, market based and income based approaches-Exchange Ratio (Swap Ratio)-Methods of determining exchange rate.<br>(Theory and Problems). |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise Case study on Changing value of Ranbaxy: Daiichi's to Sun Pharma. |

**Module – 4 Corporate Restructuring and M & A** **08 Hours**

| |
|---|
| Introduction, Organizational Restructuring, Financing Restructuring, Portfolio Restructuring, Mergers and Acquisitions as an Inorganic Growth Tool. (Theory only) |
| Teaching-Learning Process: |
| Pedagogy: case study<br>Skill Enrichment Exercise Case study on Corporate Restructuring at Aditya Birla Group. |

| **Module – 5 M & A Trends and Empirical Studies** | **08 Hours** |
|---|---|
| Introduction, Global Trends in M& A, Regional Trends and Insights , Cross –Border M & As, M & A activities in Emerging Markets( Comparative study of India and China), Sectors Analysis of M & A Trends. | |
| Teaching-Learning Process: | |
| Pedagogy: Case study discussion, articles from Magazine and research related.<br>Skill Enrichment Exercise Case Study on Vodafone and Hutch Deal | |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Analyze M&A with its different classifications, strategies, theories and

CO2: Evaluate financial implication of M&A

CO3: Analyze the results after financial evaluation of M &A

CO4: Critically evaluate different types of M&A, takeover and antitakeover strategies

CO5: Evaluate the Merger Process and identify the stages involved in it.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 % of Numerical Problems in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Mergers and Acquisitions: Valuations, Leveraged Buyouts, and Financing | Sheeba Kapil Kanwal N Kapil | Wiley | 1/e , 2016 |
| 2 | Mergers Acquisitions & Corporate Restructuring - Strategies & Practices | Rabi Narayan Kar and Minakshi | Taxmann's | 3/e, 2017 |
| 3 | Mergers, Acquisitions and Takeovers | H.R.Machiraju | New Age International Publishers | 1/e, 2010 |
| Reference Books | | | | |
| 1 | Mergers et.al.-Issues, Implications, and Case Law in Corporate Restructuring | Ramanujam S. | Tata McGraw Hill Publishing House | 2000 |
| 2 | Takeovers, Restructuring and Corporate Governance | Weston, Mitchell and Mulherin | Pearson Education | 4/e, 2003. |
| 3 | Mergers, Acquisitions and Corporate Restructuring: Text and Cases | Chandrashekar, Krishnamurti & Vishwanath S | Sage Publications | 2/e, 2018 |

**Semester: III**
**Course Name: Financial Modeling**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM306** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamental of economics and finance
- Basics of MS Excel
- Understanding of Capital market activities

**Module – 1 Overview of Financial Model** **08 Hours**

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|---|
| Concept of Financial model, types of financial models, Application of financial models, role of financial modeler, Best practices in financial modeling. Financial Modeling Life Cycle. Testing the financial model. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Study the application of financial models in forecasting |

**Module – 2 Modeling Excel Functions** **08 Hours**

| |
|---|
| Formatting of Excel Sheets, Filter and Sort. Use of Excel Formula Function (IF, AND, SUMIF, COUNTIF, AVERAGEIF, SUMIFS, VLOOKUP, MATCH, INDEX, OFFSET, and CHOOSE, Date and Time Functions). |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Apply the Excel shortcut keys |

**Module – 3 Advanced Modeling Tools and Techniques** **08 Hours**

| |
|---|
| Extrapolation, Histogram Data. Charts and Graphs. Table formula and Pivot tables. Advance financial models: Introduction to valuation, types of valuation methods, financial statement modeling using Excel. Time value of Money & Loan amortization: PV, FV, and PMT. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Prepare loan amortization model |

**Module – 4 Portfolio Analysis** **08 Hours**

| |
|---|
| Calculation of risk & return for individual stock and Portfolio. Meaning and assumption of Simple regression analysis, Application of Simple regression analysis, multiple regression analysis, Covariance and co-efficient of correlation. Descriptive statistics. |
| Teaching-Learning Process: |
| Pedagogy: Case Study, Excel based calculation, websites of NSE/BSE<br>Skill Enrichment Exercise: Prepare a portfolio using small and medium cap stocks |

**Module – 5 Econometrics** **08 Hours**

| |
|---|
| Meaning, Why a separate discipline, Types of Econometrics, Methodology of Econometrics, The Nature and Sources of Data for Economic Analysis. Measurement Scales of Variables. |
| Teaching-Learning Process: |
| Pedagogy: Case study discussion, articles from Magazine and research related.<br>Skill Enrichment Exercise: Apply the unit root tests to time series data |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Gain the knowledge of financial function and its importance in investment decisions
CO2: Identify the various techniques for financial decision making using excel
CO3: Comprehend the application of financial models in decision making.
CO4: Analyze the regression equation and its usage in policy decisions
CO5: Evaluate the risk return estimation and its implication in decision making

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Hands-On Financial Modeling with Microsoft Excel 2019 | Shmuel Oluwa | Packt | 2019 |
| 2 | The Handbook of Financial Modeling | Jack Avon | Apress | 2003 |
| | Basic Econometrics | Damodar Gujarati | McGraw-Hill | 2018 |
| **Reference Books** | | | | |
| 1 | Oxford Guide to Financial Modeling | Thomas S. Y Ho, Sang Bin Lee | Oxford University Press | 2003 |
| 2 | Introductory Econometrics :A Modern approach | Jeffrey M .Wooldridge | Cengage Publication | 7/e |
| 3 | Mastering Financial Modelling in Microsoft Excel | Alastair L Day | Pearson Publication | 2/e and 2008 |

**Semester: III**
**Course Name: Behavioural Marketing**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM301** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of Consumer Behaviour.
- Understanding towards Culture and Subculture.
- Understanding of internal and external influences

**Module – 1: Introduction to the study of Consumer Behaviour** **08 Hours**

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|---|
| Meaning & Definition of Consumer Behaviour, Difference between Consumer & Customer, Nature & characteristics of Indian Consumers, Consumerism: meaning, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to list out the Rights & Responsibilities of consumers in India. |

**Module – 2: Models of Consumer Behaviour** **08 Hours**

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|---|
| Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences, External Influences.<br>Consumer Decision Making: Consumer Buying Decision Process, Levels of Consumer Decision Making – Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages. Situational Influences- Nature of Situational Influence, Situational Characteristics and consumption behaviour. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to study the Process of consumer buying decision making. |

**Module – 3: Individual Influences on Consumer Behaviour** **08 Hours**

| |
|---|
| Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals. Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives.<br>Personality: Basics of Personality,<br>Perception: Basics of Perception & Marketing implications, Elements of Perception, Dynamics of Perception, Influence of perception on CB.<br>Attitude: Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tri-component Model of attitude, Multi attribute attitude models. Elaboration Likelihood Model).<br>Persuasive Communication: Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Case Study on buying behavior |

**Module – 4: External Influences on Consumer Behaviour** **08 Hours**

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|---|
| Social Class: Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India. Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour. Subculture: Meaning, Types of subcultures. Cross Culture - Cross-cultural consumer analysis – Cross cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems. Groups: Meaning and Nature of Groups, Types Family: The changing structure of family, Family decision making and consumption related roles, Dynamics of husband-wife decision making, Reference Groups: Understanding the power & benefits of reference groups, Factors that affect reference group influence, Types of reference group, Reference Group Appeals. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Case study on cross culture aspects |

**Module – 5: Diffusion of Innovation** **08 Hours**

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|---|
| Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders. Diffusion Process: Adoption Process, Stages, categories of adopters, Post Purchase Processes. Customer Relationship Management- Meaning & Significance of CRM, Types of CRM Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss the process of E-CRM |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Comprehend the background and vital concepts for understanding Consumer Behaviour
CO2: Identify the role of variables of Consumer models and decision making process
CO3: Identifying the psychological and Behavioural practices adopted by Organizations to enhance Consumer Behaviour.
CO4: Comprehend the role of External Influences on Consumer Behaviour
CO5: Analyze the diffusion of innovation process.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Consumer Behavior | Leon Schiff man, Lesslie Kanuk, | 10/e, Pearson, | Latest Edition |
| 2 | Consumer Behaviour: A Managerial | Perspective Dr. Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal. | 1/e, Cengage Learning | Latest Edition |
| **Reference Books** | | | | |
| 1 | Consumer Behavior in Indian Perspective | Suja Nair | Himalaya Publications | 2015 |
| 2 | Consumer Behavior: Building Marketing Strategy – Del I. | Hawkins, & Others | 11/e, TMH | Latest Edition |
| 3 | Consumer Behavior | Satish K. Batra& S H H Kazmi, | Excel Books. | Latest Edition |

**Semester: III**
**Course Name: Advanced Retail Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM302** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of Marketing Management
- Basics of Marketing Channel Management
- Basics of E-Commerce

**Module – 1 Basics of Retailing** **06 Hours**

| |
|---|
| Introduction and Perspectives on Retailing, World of Retailing, Retail management, introduction, meaning, characteristics, emergence of organizations of retailing - Types of Retailers (Retail Formats) - Multichannel Retailing -Customer Buying Behaviour, Historical Perspective, Role of retailing, Trends in retailing, FDI in Retail - Problems of Indian Retailing - Current Scenario. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Interview a retail shop floor employee in a retail store and write brief report on trends, importance and problems of retailing. |

**Module – 2 Theories of Retailing** **08 Hours**

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|---|
| Wheel of retailing, The Retail Accordion, Melting Pot Theory, Polarization theory<br>Retailing strategy for Setting up Retail organization and planning:<br>Retail Market Strategy - Financial Strategy - Site & Locations (Size and space allocation, location strategy, factors Affecting the location of Retail, Retail location Research and Techniques, Objectives of Good store Design.)<br>Human Resource Management, Information Systems and Supply chain management & Logistics |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Visit kirana store and a supermarket and compare the following: a) Store arrangement b) No of brands carried c) Pricing policies – are discounts given? d) Service – personal or impersonal? |

**Module – 3 Store Management and Visual Merchandising** **08 Hours**

| |
|---|
| Store Management: Responsibilities of Store Manager, Store Security, Parking Space Problem at Retail Centers, Store Record and Accounting System, Coding System, Material Handling in Stores, Management of Modern retails –Store Layout, design: Types of Layouts, Role of Visual Merchandiser, Visual Merchandising Techniques, Controlling Costs and Reducing Inventories Loss, Exteriors, Interiors Customer Service, Planning Merchandise Assortments -Buying systems -Buying merchandise and Retail Communication Mix. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Visit at least three kirana stores in your neighborhood (around 2 kms) meet 15-20 retail customers and discuss the importance of location, pricing, credit policy, etc. |

**Module – 4 Retail Pricing and Retail Research** **08 Hours**

| |
|---|
| Retail Pricing: Factors influencing retail pricing, Retail pricing strategies, Retail promotion strategies Relationship Marketing in Retailing: Management & Evaluation of Relationships in Retailing, Research in Retailing: Importance of Research in Retailing, Trends in Retail Research, Areas of Retail Research. Customer Audits, Brand Management in retailing Internationalization of Retailing: Evolution of International Retailing, Motives of International Retailing, International Retail Environment, Issues in International Retailing |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Draft a detailed report on comparing Physical store retailer and online about the price and pricing strategies. |

**Module – 5 Foundation of e-Retailing** **10 Hours**

| |
|---|
| Meaning, Definition, Transition from Traditional Marketing to e-Marketing, Demographics and Targeting, Adaptability and Closed – Loop Marketing, Advantages of e-Retailing, Shortcomings of e-Retailing.<br>E-Retailing: The Application Domain: e-Retailing Practices, e-Retailing Application Perspective, e-Retailing Online Merchandising Techniques, Online Store Front, Creating Look & Feel, Online Brand Management, Online Purchasing.The Current Trends: Current Trend Analysis and Measures, Current Status of Online Retailing, e-Retailing Statistics |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Presentation on any retailing company specific to E-CRM |



**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Visualize and apply the contemporary retail management, issues, and strategies to scenario for retail application.
CO2: Comprehend and analyzing the strategic significance components in functionalizing of retail organization.
CO3: Evaluating the various methods and techniques of Retail operations and Store management.
CO4: Develop comprehensive research plans by accessing the retail scenario for business decisions.
CO5: Effectively communicate the Marketing mix in the age of E-retailing.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Retail Management | Levy &Weitz | McGraw Hill | Latest Edition |
| 2 | Retail Management-A Global Perspective: Text and Cases | Dr. Harjit Singh | S.Chand | Reprint 2018 |
| 3 | Retail Management | Chetan Bajaj | Oxford University press | Latest Edition |
| 4 | e-Retailing | Eleonora Pantano Bang Nguyen Charles Dennis Sabine Gerlach | Routledge Ebusiness | Latest Edition |
| **Reference Books** | | | | |
| 1 | Integrated Retail Management | James R. Ogden & Denise Trodden, Biztantr | Latest Edition | Integrated Retail Management |
| 2 | Retail Marketing Management | Dravid Gilbert, | Pearson Education | Latest Edition |
| 3 | Retailing and E-Tailing | Ramesh Mittal, Ruchi Nayyar, S. L. Gupta | International Book House | 1st Edition |

**Semester: III**
**Course Name: Services Marketing**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM303** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of Marketing Management.
- Understanding towards Services Industry.
- Differences among Product and Services.

**Module – 1 Introduction to Services** **08 Hours**

| |
|---|
| What are services, Why service marketing, Difference in goods and service in marketing, Myths about services, Concept of service marketing triangle, Service marketing mix, GAP models of service. Consumer Behaviour in Services: Search, Experience and Credence, property, Customer expectation of services, Two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services Customer perception of Services- Factors that influence customer perception of service, Service encounters, Customer satisfaction, Service quality, Strategies for influencing customer perception. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Students are asked to choose a service industry of their and list out the different service organizations in the particular industry. |

**Module – 2 Understanding Customer Expectations through Market Research** **08 Hours**

| |
|---|
| Using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies, Market segmentation- Process & targeting in services, Retention strategies Monitoring relationship, 3 levels of retention strategies. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Students are asked to conduct an in-depth study towards understanding the customer expectation of any service customer has availed recently. |

**Module – 3 Customer Defined Service Standards** **08 Hours**

| |
|---|
| "Hard" & "Soft" standards, challenges of matching supply & demand in capacity, four common types of constraints facing services, optimum v/s maximum use of capacity, strategies for matching capacity & demand. Yield management-balancing capacity utilization, pricing. Waiting line strategies- four basic Waiting line strategies. Leadership &Measurement system for market driven service performance-key reasons for GAP-2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Students are asked to prepare service blueprints for any service of their choice. |

**Module – 4 Employee Role in Service Designing and Delivery** **08 Hours**

| |
|---|
| Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3.<br>Customer's role in service delivery-Importance of customer & customer's role in service delivery, Strategies for enhancing-Customer participation, Delivery through intermediaries-Key intermediaries for service delivery, Intermediary control strategies. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Students are asked to identify any existing services, locate loopholes in the service design and suggest modifications. |

**Module – 5 Services Marketing Communication** **08 Hours**

| |
|---|
| Role of services marketing communication- Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery.<br>Pricing of services- Role of price and value in provider GAP 4, Role of non-monitory cost, Price as an indicator of service quality –Approaches to pricing services, pricing strategies, SERVQUAL Model.<br>Physical evidence in services: Importance of Physical Evidence, Elements of Physical Evidence, Physical Evidence Strategies, Guidelines for Physical Evidence.<br>Service scapes: Types of service scapes-Objective and Goals of services capes Role of services capes, Approaches for understanding service scapes effects,<br>Frame work for understanding services capes & its effect on behaviour-Guidance for physical evidence strategies. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Mini Project – On measuring SERVQUAL |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Utilize the concepts of the services marketing with the overview of customer behavior towards service industry.
CO 2: Analyze the customer expectation by appropriate tools and frame works.
CO 3: Evaluate and develop the service outcomes with appropriate leadership strategies.
CO 4: Design the service process with focus on employees and customer relationships.
CO 5: Communicate service contents by appropriate element of service infrastructure over viewing the service scape and physical evidence.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Services Marketing | Valarie A Zeithmal & Mary Jo Bitner | McGraw Hill | 6th Edition |
| 2 | Services Marketing | Christopher Lovelock | Pearson Education | Latest Edition |
| **Reference Books** | | | | |
| 1 | Services Marketing | Rajendra Nargundkar | McGraw Hill | Latest Edition |
| 2 | Services Marketing | Hoffman & Bateson | Cengage Learning | Latest Edition |
| 3 | Services Marketing: Operation, Management and Strategy | Strategy-Kenneth E Clow& David L. Kurtz | Biztantra | Latest Edition |

**Semester: III**
**Course Name: Marketing Research & Analytics**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM304** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of Marketing Analytics
- Understanding towards uses of analytics
- Basis of Marketing Research

**Module – 1: Introduction of Marketing Analytics** **08 Hours**

| |
|---|
| Introduction of Marketing Analytics, Market Segmentation Variables, Market Segmentation Types, Marketing Data Landscape, Data for Segmentation, Analytics for Need Based Segmentation - Voice of the Customer, managing "Voice of the Customer" Data, Customer Co-Creation, RFM Analysis, Life Cycle Segmentation, Cross Tabulation Segmentation, Clustering, Conjoint Analysis Segmentation, The Cluster Analysis + Discriminant Analysis Approach. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to list the 5 uses of marketing analytics. |

**Module – 2: Marketing Information System** **08 Hours**

| |
|---|
| Importance, Relevance of MkIS, Marketing Research (MR) and MkIS, The Marketing information systems and its subsystems, four components: user interfaces, application software, databases, and system support. Advantages & disadvantages of marketing information systems. Internal reporting. Approaches to Choosing Target Segment/s: Rationale for Segment Targeting, Analytics for Perceptual Mapping and Product Positioning. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss about application of MkIS |

**Module – 3: Marketing Research Database** **08 Hours**

| |
|---|
| Definition of Marketing Research Database, Use of Decision Support Systems in Marketing Research, Data base & Data warehousing. The three Vs: Volume, Velocity & Varity, The Fourth V: Value. Elements of data base, types of data base, using marketing data base for marketing intelligence, ways to gather consumer data, Data Mining, benefits of data mining, Big Data Analysis, Descriptive Analysis, Prescriptive Analysis, Key challenges of Big Data Integration. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to differentiate between Descriptive and Prescriptive analytics and their applications. |

**Module – 4: Types of Marketing Research** **08 Hours**

| |
|---|
| Introduction, Consumer Market Research, Business-to-Business Market Research, Product Research, Pricing Research, Motivational Research, Distribution Research, Advertising Research, Media research, |

| |
|---|
| Sales Analysis and Forecasting. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to undergo a Mini project on Product Research. |

**Module – 5: Modeling New Marketing Initiatives** **08 Hours**

| |
|---|
| Introduction to modeling, evaluating new ad channels, Modeling tips and best practices, Projecting ad revenue, projecting organic follower revenue, Projecting expenses, calculating net profit and breakeven, Understanding ROI, calculating returns, creating a single-variable sensitivity table. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked discuss about the ROI of a Project |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Describe the use of Voice of the Customer data in making data driven marketing decisions.
CO2: Demonstrate an understanding of utility theory to measure customer preferences and choices.
CO3: Identify what customers' value in a product, and assess what they are willing to pay for it.
CO4: Illustrate the use of various tools and frameworks to solve strategic marketing problems using marketing data.
CO5: Analyze the most effective target markets and incorporates the key tools of Marketing Analytics.

**Assessment Details**

**CIE:**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each fullquestionisfor20marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Marketing Research an Application Orientation- | Naresk K | Pearson, | Malhotra, 6/e, 2013. |
| 2 | Marketing Analytics: Data-Driven Techniques with Microsoft Excel | Wayne L. Winston | John Wiley & Sons | 2014 |
| **Reference Books** | | | | |
| 1 | Predictive Analytics, Data Mining and Big Data- S. | Finlay, Palgrave | Macmillan Publishing. | 2014 |
| 2 | Marketing Analytics: A Practical Guide to Improving Consumer Insights Using Data Techniques | Mike Grigsby | McGraw Hill | . 2018 |

**Semester: III**
**Course Name: Business Marketing**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM305** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
Students should have basic knowledge of
- Basic concepts of marketing.
- Understanding of various business units.
- Analyzing of typical business situations.
- Understanding of business plans and its actions.

**Module 1 - Dimensions of Industrial Marketing & Buying** **08 Hours**

| |
|---|
| Nature of Industrial Marketing, Industrial Marketing vs. Consumer Marketing, Economics of Industrial demand – The Resellers Market – The Industrial Marketing Concept, Understanding Industrial Markets, Types of Industrial Markets. Organizational buying Activity, Buying models and buying centre concept, Inter Personal Dynamics of Industrial Buying Behavior, Roles of Buying centre, Ethics in Purchasing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Ethical issues in Business marketing will be discussed with examples. |

**Module 2 - Market Segmentation & Product Planning** **08 Hours**

| |
|---|
| Choosing Target Segments, Positioning, Differentiated and Un-Differentiated Markets, Concentrated and Niche Markets, Positioning Strategies, Difference between Industrial Market Research and Consumer Market Research.<br>Product Planning: Developing Product Strategy, Analyzing Industrial Product Life Cycle, Developing Strategies for new and existing products Business Service Marketing: Special Challenges. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Case study on positioning strategies. |

**Module 3 - Formulating Channel Strategy & Pricing Strategies** **08 Hours**

| |
|---|
| Industrial Distributor, Definition, Geographical Distribution, Size Characteristics, operating characteristics, Role of Sales Agent and their drawbacks, choice of the right Distributors.<br>Pricing strategies: Price Determinants, Factors that Influence the Pricing Strategies, concept of learning curves, Pricing Strategies, Competitive Bidding, and Leasing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Visit a retail store and observe the roles of sales agent and the strategies they use to market products/services and write a report. |

**Module 4 - The Promotional Strategies** **08 Hours**

| |
|---|
| Advertising in Industrial Markets, uses, Message Formulation, policies, media, budgetary support, evaluation of advertising- sales Promotion- Use of Sales Promotion in Industrial Markets, trade shows and exhibitions B 2 B Forms of E-Commerce. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Students can visit industrial/ B2B trade shows or exhibition and prepare a report. |

**Module 5 - Management of Sales Force & B2B in E-Commerce** **08 Hours**

| |
|---|
| Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for the sales force Deployment. Personal Selling: Selecting and Recruitment of Industrial sales person, sales training, Directing, Motivating, Task Assignment, Compensation, Measuring the Effectiveness of Sales Force.<br>B2B Through E-commerce: B2B form of E-commerce, models for B2B e-commerce, marketing strategy for electronic market place. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Case study on importance of e-commerce in industrial marketing. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: To apply the fundamental related concepts of business & industrial marketing.
CO2: To analyze the different business buying behaviour of industrial customers.
CO3: To evaluate the business situations in the context of buyer- seller relationship.
CO4: To Design an integrated marketing communications plan for pricing & promoting B2B products or services.
CO5: To build Salesforce approaches and models with the significance of e-commerce in business marketing.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

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- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Business Marketing | Krishna K Havaldar | Tata McGraw Hill Publication | Latest Edition |
| 2 | Industrial Marketing | Robert R Reeder & Reeder | Prentice –Hall, International Publication | $2^{nd}$ Edition |
| **Reference Books** | | | | |
| 1 | Business Marketing | Frank G Bingham | Tata McGraw Hill Publication | Latest Edition |
| 2 | Industrial Marketing | Mukherjee H S | Excel Books Publication | Latest Edition |
| 3 | Business Marketing Management | Michael D Hutt, Thomas W Speh | Cengage Learning Publication | Latest Edition |

**Semester: III**
**Course Name: TOURISM MARKETING**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM306** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Fundamentals of Marketing Management.
- Understanding towards Services Marketing.
- Basis of Tourism and Travel Industry.

**Module – 1 Basics of Tourism Marketing** **06 Hours**

| |
|---|
| Evolution of Marketing – The Tourism Product – Features of Tourism Marketing – Marketing Functions – Market Research – Tourism Marketing Mix. |
| Teaching-Learning Process: |
| Pedagogy Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to list the 05 companies in Tourism Industry with detailed profile and SWOT analysis of the company. |

**Module – 2 Tourism Consumer** **008 Hours**

| |
|---|
| Understanding the Market and the Consumer – Marketing Environment – Consumer Behaviour – Buyer Decision Process – Demand Forecasting - Market Segmentation – Targeting – Market Positioning. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss the factors affecting consumer motivation and demand in the travel and tourism sector. |

**Module – 3 Tourism Product Mix** **10 Hours**

| |
|---|
| Product Designing – Branding and Packaging – New Product Development – Product Life Cycle. Tourism Pricing: Factors Influencing Pricing – Pricing Objectives – Procedure – Policies – Methods. Tourism Place: Logistics of tourism products – Place of ambience of site in tourism marketing – Accommodation of tourists – Online services in tourism. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to assess the importance of the service sector mix elements to the travel and tourism sector. |

**Module – 4 Tourism Promotion** **08 Hours**

| |
|---|
| Advertising: Meaning – Objectives – Deciding Advertising Budget – Advertising Copy/Layout – Media Planning, Selection and Scheduling – Measuring Advertising Effectiveness – Personal Selling: Meaning – Personal Selling Process –Sales Promotion: Methods and Strategies – Direct Marketing – Tele Marketing – Event Marketing – Public Relations – Promotion through Internet. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Analyze the importance of Strategic Marketing planning for a selected travel and tourism business or tourist destination. |

**Module – 5 Physical Evidence and Process in Tourism** **08 Hours**

| |
|---|
| Tourism planner – Tourism arrangement process – Procedure involved in tourism. People in Tourism: Employee behavior in tourism organizations – Tourists orientation – Trends in Tourism Marketing – Marketing of Destinations, Airlines, Hotels, Resorts, and Travel Agencies, Events and other Tourism sub-sectors and products. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Mini Project – on Travel Digital Channels. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts of the marketing with the overview of customer behavior towards tourism industry.

CO2: Analyze the tourism customer expectation by appropriate tools and frame works for devising tourism marketing strategies.

CO3: Evaluate and develop the product mix strategies for tourism business and organizations.

CO4: Design the promotional strategies through advertising, sales promotion and manage the sales force for efficient marketing.

CO5: Communicate the appropriate element of tourism infrastructure over viewing the physical evidence and process.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Marketing for Hospitality and Tourism | Philip Kotler, Jon Bower, James Maken | Pearson Education | 7th Edition |
| 2 | Tourism Marketing & Management Handbook | Stephen F. Wilt and Luiz Mountinho | Abhijeet publications | 1st Edition |
| **Reference Books** | | | | |
| 1 | Tourism Marketing (English, Hardcover | Badan B.S, Harish Bhat | Commonwealth Publishers | Latest Edition |
| 2 | Tourism Marketing | Dasgupta Devashish) | Pearson Education | Latest Edition |

**Semester: III**
**Course Name: Talent Acquisition**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR301** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Good communication and Presentation Skills.
- Knowledge of Selection process and Tools in the Corporate Sector.
- Basics of Hiring System.

**Module – 1 Recruitment Analytics** **08 Hours**

| |
|---|
| Concept of Work, Organization's Work and Jobs; Remote Work, Hybrid work and Work from Office, Millennials at the work place; Key Characteristics of Millennials; Types of Millennial; The Evolution of Work Structure; Organizing the Work; Strategic Job Redesign and Its Benefits; Strategic Issues in Recruitment; What makes Bad Recruitment; Overview of the Hiring Process; Recruitment Metrics; Factors Affecting Recruitment; Recruitment Strategy: An Internal Approach; An External Approach; Legal and Ethical Considerations; Organizational Best Practices. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Draft a Man Power Planning for a Manufacturing Unit. |

**Module – 2 Job Analysis & Job Evaluation** **08 Hours**

| |
|---|
| Identify the Job to Examine; Determine Appropriate Sources of Information, Collection of Job-Related Data; Job Description; Competency and Competency Ice Berg Model; Why Competency Based Recruitment; Sources of Recruitment; Employer Branding – Meaning and Significance; Social Media-Use of Social Media in Recruitment & Selection; Job Design.<br>The Job Evaluation Process; Obtain Job KSAOs, Qualifications, Working Conditions, and Essential Duties; Examine Compensable Factors Using the Rating/Weighting Evaluation Method; Determine Overall Job Value; Hay Group—Pioneer in Job Evaluation; Determining Compensation using Job Evaluation Data; Legal and Ethical Considerations for Job Evaluation. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Prepare a Job Description for various levels of jobs |

**Module – 3 Selection and Interview Strategy** **08 Hours**

| |
|---|
| Interview Strategy and Process; Millennials Shaping the Recruitment Landscape in the Organizations; Strategies for Recruiting and Selecting Generation Y into the Workforce. Interviewers; Interviewing Techniques; Legal and Ethical Considerations in the Interview Process; The Overall BEI Process; Assessment Centers; Simulations. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Design job Advertisements for various levels of jobs |

**Module – 4 Testing and Assessment** **08 Hours**

| |
|---|
| Test related to Assessment of Knowledge, Skills, and Abilities; Personality Assessment; The Birkman Method and MBTI® comparison; Honesty and Integrity Assessment; Various Non-Interviewing Methods- Meaning and Significance; Graphology; Skills Assessment; Games and Group Activity for Leadership Assessment; Administration of Tests and Assessments; Key Interviewer Skills. Recent Trends in Recruitment and Talent Acquisition, Use of Technology in Recruitment & Selection. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Prepare Selection Test Questions to identify Skills and Abilities of candidates |

**Module – 5 Final Assessment & Placement** **08 Hours**

| |
|---|
| Unique Recruitment Strategies; Resume, CV and Application Forms; Implications of Using Social Media Content in Hiring Decisions; Background Checks; Reference Checks; Pre-employment Testing; Job Offer; Transitioning from Job Candidate to Employee; Induction; Placement. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Draft your Resume |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the knowledge of recruitment metrics and recruitment analytics in manpower planning of an organization.

CO2: Apply the knowledge of job analysis and various techniques of job analysis in recruitment and selection process.

CO3: Evaluate various selection and interview strategies.

CO4: Construct various selection tests to evaluate ability of candidates in selection process.

CO5: Design various documentations to execute selection process.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
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| | **Total Marks** | | | **50** |

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- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | How to Recruit, Incentives and Retain Millennials. | Rohtak | Sage Publications | 2019 |
| 2 | Recruitment and Selection- Strategies for Workforce Planning & Assessment | Carrie A. Picardi | Sage Publication | 2019 |
| 3 | Human Resource Management | R. C. Sharma | Sage Publication | 2019 |
| **Reference Books** | | | | |
| 1 | Human Resource Management: | Amitabha Sengupta | Sage Publication | 2018 |
| 2 | Leadership: Theory and Practices | Peter G. Northouse | Sage Publication India Pvt. Ltd | 7/e, 2016 |
| 3 | Performance Management and Appraisal System | T. V Rao | Response Books | 2004 |

**Semester: III**
**Course Name: Human Resource Analytics**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR302** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Analytical skills
- Statistical Proficiency
- Good Decision Making skills
- Logical Reasoning

**Module-1 Introduction to HR Analytics** **08 Hours**

| |
|---|
| Concept and Definition of Analytics; HRM and Strategy; Reinforcement of HR Strategy factors with HR Analytics; HRM as a Process & System; Transition of HRM to HCM; Sustainable Competitive Advantage through Human Capital; Importance & Benefits of HR Analytics, HR Decision making and HR Analytics; Aligning HR to Business through HR Analytics; Steps for Alignment of HR Analytics with Business Goals and Strategies; Challenges to HR Analysts |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Learning insights on importance of Analytics and its strategic alignment with the Business performance |

**Module – 2 HR Analytics and Data** **08 Hours**

| |
|---|
| HR Data and Data Quality, Employee Data sources; HRIS for HR Decision Making; Levels of HR Analysis, Conducting HR Analytics; HR Data collection; Transforming HR Data in to HR Information; Process of Data collection for HR Analytics & Effective HR Measurement; Analytics Frameworks : LAMP, HCM:21 Model |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on Importance of HR data sources for effective decision making in the organizations |

**Module – 3 HR Metrics and its Application** **08 Hours**

| |
|---|
| HR Metrics: Meaning, Types: Recruitment Metrics; Training & Development Metrics; Staffing Metrics; HR Dashboards; HR Scorecard;<br>Dashboards: Few Key Excel Add-ins/Functions to Help Create Dashboards, Name Range, The Developer Tab, Form Controls, Important Excel Formulas Useful for Creating Dashboards, VLOOKUP, INDEX, SUMIF, AVERAGEIF and COUNTIF. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on importance of HR metrics and its practical applicability |

**Module – 4 HR Analytics Applications** **08 Hours**

| |
|---|
| Correlation & Regression: Correlation Analysis, Simple Linear & Multiple Regression Analysis, Interaction Effects. Comparison of Means and ANOVA, One-Sample T-test, Null and Alternate Hypotheses, Paired Sample T-Test, Independent-Sample T-Test, Analysis of Variance, Factor Analysis; Cluster Analysis<br>Software for Statistical Analysis: MS-Excel, IBM- SPSS, IBM-AMOS, SAS, and R programming and data visualization tools such as Tableau, Ploty, Click view and Fusion Charts |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: practical application of statistical tools |

**Module – 5 HR Predictive (RBT Modeling** **08 Hours**

| |
|---|
| Case study: HR Predictive Modeling; Predictive Analytics Tools & Techniques, Conducting Hypotheses testing using Statistical Software |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Practical application of Predictive analysis |

**Course Outcomes:**

CO1: Apply the concepts of Analytics in HR process
CO2: Interpret conceptual knowledge of HRA frameworks, models, and approaches
CO3: Elaborate the use of employees' data set, considering the various concepts and functions of HR facilitating decision making in business context.
CO4: Discuss the application of datafication of HR, by using analytics tools and techniques
CO5: Analyze HR analytics and predictive modeling used in HR functions

**Assessment Details**

**CIE:**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Practical Applications of HR Analytics 2019 | Pratyush, Banerjee; Jatin Pandey; Manish Gupta | SAGE Texts, India | 2019 |
| 2 | HR Analytics- Understanding Theories and Applications | Bhattacharya, Dipak Kumar | SAGE Texts, India | 2017 |
| 3 | Winning on HR Analytics- Leveraging Data for Competitive Advantage | Ramesh, Soundarajan and Kuldeep Singh | Sage Publication India Pvt. Ltd. | 2016 |
| 4 | Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration | Sesil James, C , | Pearson, New Jersey | 2017 |
| 5 | Predictive Analytics- Mastering the HR Matrix | Martin Edwards and Kirsten Edwards | Kogan Page | 2019 |
| **Reference Books** | | | | |
| 1 | Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration | Sesil James, C | Pearson, New Jersey | 2017 |
| 2 | Predictive Analytics- Mastering the HR Matrix, | Martin Edwards and Kirsten Edwards, | Kogan Page, | 2019 |
| 3 | Fundamentals of HR Analytics: A Manual on Becoming HR Analytical | Fermin Diez, Mark Bussin, Venessa Lee, , | Emerald Publishing Limited | 2019 |

**Semester: III**
**Course Name: Organizational Change Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR303** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basics of Organizational Behavior.
- Basics of Organization change & Development.
- Knowledge of internal and external environment of business.
- Knowledge of Strategic Management Concepts.

**Module – 1 Changing Organizations – Introduction** **08 Hours**

| |
|---|
| Nature of 21st Century Organization, Defining Organizational Change, The Roots of Organization Change, Environmental Forces, Driving Change Today, The Implications of Worldwide Trends for Change Management, Four Types of Organizational Change, Planned Changes and Intended Results, Organization Change Roles, Change Initiators, Change Implementers, Change Facilitators, Change Recipients,<br>Concept of OD, OD in India, OD Activities, Values, Beliefs and Assumptions of OD, Laboratory Training and T-Groups Action Research and Survey Feedback, Employee Involvement, Organizational Culture, Reengineering Organizational Learning, Organizational Effectiveness and Employee Engagement, Defining Values, Values Important to the OD Practitioner, Core Values of OD, Changes to OD Values, Values Statement of OD, Ethical Issues of OD. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Discuss Successful OD Interventions of various companies |

**Module – 2 The Need for Change** **07 Hours**

| |
|---|
| Building and Energizing the Need for Change: Organizations as Systems, Levels and Characteristics of Organizational Change, Models of Organizational Change, Systems Theory and Social Construction Approaches, Developing a Knowledge for the Need for Change, Seek Out and Make Sense of Internal - External Data, The Organizations' Readiness for Change, Creating Awareness of the Need for Change, Factors That Block People From Recognizing the Need for Change, Creating a Powerful Vision for Change, The Difference Between an Organizational Vision and a Change Vision. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Analyze Business Environment of an Organization |

**Module – 3 Measuring the Change** **07 Hours**

| |
|---|
| Designing Effective Control Systems for Measuring the Change: Using Control Processes to Facilitate Change, Selecting and Deploying Measures, Use Measures that Lead to Challenging but Achievable Goals, Use Measures and Controls that are Perceived as Fair and Appropriate, Ensure Accurate Data, Control Systems and Change Management, Controls During Design and Early Stages of the Change Project, Measurement Tools to use in Change Process, Strategy Maps, The Balanced Scorecard, Risk |

| |
|---|
| Exposure Calculator, Organizational Change Agent, Orienting Yourself to Organization Change, Data Gathering, Diagnosis and Feedback. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Meet and Interact with OD and Change Manager and ask- 10 questions related to Change Management |

**Module – 4 Models of Change** **10 Hours**

| |
|---|
| Models of Change, Comparison and Critical Analysis of Change Models Plan the Work, Selecting the Correct Path, Engage Others in Action Planning, Working the Plan Ethically and Adaptively, Developing a Communication Plan, Key Principles in Communicating for Change, Transition Management. Ensure Alignment in Your Action Planning, Action Planning Tools: 1) To-Do Lists; 2) Responsibility Charting; 3) Contingency Planning; 4) Surveys and Survey Feedback; 5) Project Planning and Critical Path Methods;6) Force Field and Stakeholder Analysis; 7) Leverage Analysis and 8) Other Change-Management Tools. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Visit an Organization and Interact with Employees in the Organization and discuss Culture Impact on Change process and how it can be managed. |

**Module – 5 Master Change Agent** **08 Hours**

| |
|---|
| Factors That Influence Change Agent Success, The Interplay of Personal Attributes, Situation, and Vision, Change Leaders and Their Essential Characteristics, Developing into a Change Leader-Intention. Education, Self-Discipline, and Experience, Developmental Stages of Change Leaders, Four Types of Change Leaders, Internal Consultants: Specialists in Change, External Consultants: Specialized, Paid Change Agents, Provide Subject-Matter Expertise, Bring Fresh Perspectives from ideas that have worked elsewhere, provide independent, trustworthy Support, Limitations of External Consultants, Change Teams, Change from the Middle: Everyone Needs to Be a Change Agent, Rules of Thumb for Change Agents,<br>Types of Consulting, Consulting Model, OD Practitioners, The Organization Development Consulting Profession, The OD Consulting Process and Action Research |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Prepare a Change Management Model for Manufacturing Company |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the understanding of OD aspects in private and public sectors in India.
CO2: Analyze the need for change in an organization.
CO3: Analyze the tools and techniques available to implement changes in an organization.
CO4: Evaluate various models of change to manage an organization in changing environment.
CO5: Design a plan for Organization Change Management.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Change Management and Organisational Development | Ratan Raina | SAGE Texts | 2018 |
| 2 | Organisational Change- An Action-Oriented Toolkit | Gene Deszca, Cynthia Ingols, Tupper F. Cawsey | SAGE Publications, Inc | 2019 |
| 3 | Organisation Development: The process of Leading Organisational Change | Donald L. Anderson | Sage Publication India Pvt. Ltd. | 2/e, 2012 |
| **Reference Books** | | | | |
| 1 | Organisation Development | Donald L. Anderson | SAGE South Asia | 2013 |
| 2 | Toolkit for Organisational Change | T. F. Cawsey, Gene Deszca | SAGE Text | 2007 |
| 3 | Organisation Development and Organisational Change | Donald L. Anderson and Tupper F. Cawsey | SAGE Publications | 1/e, 2014 |

**Semester: III**
**Course Name: Learning and Development**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR304** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basic knowledge on learning practices
- Basic knowledge about training needs
- Familiarize with various training programs

**Module – 1 Introduction to Learning** **08 Hours**

| |
|---|
| Learning: Meaning and significance, The Forces Influencing Working and Learning, classification of learning capabilities, learning theories- Reinforcement Theory, Social Learning Theory, Goal Theories, Expectancy Theory, Adult Learning Theory, pedagogy and andragogy; The basic principles of learning, The Learning Process, Mental and Physical Processes, The Learning Cycle. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Study the importance of learning from employees of various organizations |

**Module – 2 Training Strategies and Designing Training** **08 Hours**

| |
|---|
| Strategic Training and development Process, Training needs in different strategies, Models of Training Department. Training needs Assessment, Reasons for planned training. Designing the training program, developing the group and the climate, Trainers and training styles, evaluating training and Follow-on support. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Identify the training strategies conducted in organizations |

**Module – 3 Training methods** **08 Hours**

| |
|---|
| Traditional methods- Presentation methods, Hands-on methods, Group Building Methods, e-learning and use of technology in training- Technology influence on training and learning, Technology and multimedia, computer- based training, 360 degree training, Immersive Training, developing effective online learning, blended learning, mobile technology and training methods, technologies for training Administration, Learning Management Systems (LMSs), Choosing New Technology Training Methods. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Study on the recent training methods adopted by organizations |

**Module – 4 Training Evaluations** **08 Hours**

| |
|---|
| Meaning, Reasons for Evaluating Training and significance of training evaluation, Donald Kirkpatrick's |

| |
|---|
| Evaluation Model, Return on investment in Training, Types of Evaluation Designs, Considerations in Choosing an Evaluation Design, data collection for training evaluation, Threats to Validity, Determining Costs, Evaluation Practices in different organizations. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Analysis on evaluation practices in different organizations |

**Module – 5 Contemporary Issues in Training and Development 08 Hours**

| |
|---|
| Career Management: Need, Increased Use of New Technologies for Learning, Increased Demand for Learning for Virtual Work Arrangements, Increased Use of Training Partnerships & Outsourcing Training. Orientation training, diversity training, sexual harassment training, team-training, cross functional teams, cross cultural training, training for talent management and competency mapping. Career Management: A Model of Career Development (Career Stages) |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Study on the latest technologies used for training employees |

**Course Outcomes:**

CO1: Apply the fundamentals of learning theories in training programs in organization.
CO2: Analyze the training strategies and need assessment in organization.
CO3: Design and implement various contemporary methods of training and development.
CO4: Evaluate training evaluation practices in different organizations.
CO5: Create various career management systems using new technologies in achieving organizational goals.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Effective Training | P Nick and Blanchard | Pearson Education/PHI | 2nd Edition, 2005 |
| 2 | Training & Development | Dr. B. Janakiraman | Biztantra/Wiley Dreamtech | 2005 |
| 3 | Employee Training & Development | Noe A Raymond | McGraw Hill Publication | 2e, 2011 |
| 4 | Management Training and Development | Gupta B.L | Vrinda Publications | 1st Edition, 2011 |
| 5 | Training and Development Methods | Dr. Rishipal | S. Chand | 1st Edition, 2011 |
| **Reference Books** | | | | |
| 1 | Effective HR Training Development Strategy | Ratan Reddy | Pearson | 4e, 2012 |
| 2 | Training for Development | Rolf Lynton, Uday Pareek | Sage Publication | 2012 |
| 3 | Training and Development | G. Pandu Naik | Excel Books | 2011 |

**Semester: III**
**Course Name: Employee Relations & Labour Laws**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR305** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Knowledge on Basic concepts of HR,
- Importance of Labour Laws in the workplace,
- Knowledge on different types of issues at workplace environments,

**Module – 1 Fundamental Aspect of Industrial Relations** **08 Hours**

| |
|---|
| Introduction, Nature of Industrial Relations, Approaches to Industrial Relations, Trade Unions: The Participants of Industrial Relation Activities, State and Employer/Management. The Participants of Industrial Relation Activities; Evolution of Labour Legislation in India - History of Labour Legislation in India, Objectives of Labour Legislation, Types of Labour Legislations in India, Constitutional Provisions for the Protection of Labour Workforce in India, Rights of Woman Workers; The Present Labour Laws and Codes |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: influence of Trade unions on Management decision making |

**Module - 2 Factories Act, 1948** **08 Hours**

| |
|---|
| Introduction, Objectives, Scope and Important Definitions, Approval, Licensing and Registration of Factories, Health and Safety of Workers, Provisions Related to Working Conditions, Hazardous Processes, Employee Welfare and Working Hours, Employment of Young Persons and Women, Annual Leaves with Wages, Penalties and Contingence of Offences |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Application of Factories Act 1948 on different Industries |

**Module – 3 Social Security Act** **08 Hours**

| |
|---|
| The Employees' Compensation Act, 1923<br>Introduction, Objectives, Scope and Important Definitions of the Act, Eligibility, Rules for Workmen's Compensation, Amount and Distribution of Compensation, Notice, Claims and Other Important Provisions, Enforcement of Act and Provisions for Penalty<br>The Employees' State Insurance Act, 1948<br>Introduction, Objectives, Scope and Important Definitions, Administration of the Act, Finance and Audit, Contribution, Benefits, Obligations of Employers under the Act, Adjudication of Disputes, Claims and Penalties, Exemptions<br>The Maternity Benefit Act, 1961<br>Introduction, Objectives, Scope and Important Definitions, Provisions Related to Maternity, Benefits, Enforcement of the Act, Penalties and Offences, Miscellaneous Provisions of the Act |

| |
|---|
| The Employees' Provident Funds and Miscellaneous Provisions Act, 1952<br>Introduction, Objectives, Scope and Important Definitions, Administration of the Schemes under the Act, Administration of the Act,<br>The Payment of Gratuity Act, 1972<br>Introduction, Objectives, Scope and Important Definitions, Payment and Forfeiture of Gratuity and Exemption, Compulsory Insurance and Protection of Gratuity, Determination and Recovery of Gratuity, Enforcement of the Act, Penalties and Offences. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on Implementation of Social security Act in Indian companies |

**Module – 4 Wages Act** **08 Hours**

| |
|---|
| The Payment of Wages Act, 1936<br>Introduction, Objectives, Scope and Important Definitions, Provisions for Payment of Wages, Deductions from Wages, Enforcement of the Act, Penalties and Offences, Miscellaneous, Provisions of the Act<br>The Minimum Wages Act, 1948<br>Introduction, Objectives, Scope and Important Definitions, Fixation and Revision of Wages, Payment of Minimum Wages, Enforcement of the Act, Penalties and Offences, Miscellaneous, Provisions of the Act<br>The Payment of Bonus Act, 1965<br>Introduction, Objectives, Scope and Important Definitions of the Act, Eligibility, Disqualification and Amount of Bonus, Calculation of Bonus, Special and Miscellaneous Provisions, Dispute, Penalties and Offences |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminar<br>Skill Enrichment Exercise: Analyzing compensation plans of different Industries |

**Module – 5 Regulating Employer-Employee Relations Act** **08 Hours**

| |
|---|
| The Industrial Disputes Act, 1947<br>Introduction, Objectives, Scope and Important Definitions, Procedure for Settlement of Industrial Disputes and Authorities under the Act,<br>The Industrial Employment (Standing Orders) Act, 1946<br>Introduction, Objectives, Scope and Important Definitions of the Act, Procedure for Certification of Standing Orders, Other Provisions Relating to Standing Orders, Miscellaneous Provisions of the Act, Penalties and Offences<br>The Trade Unions Act, 1926: Introduction, Objectives, Scope and Important Definitions |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussions on affects of Employees-Employer Relations on Organization's performance |

**Course Outcomes:**

CO1: Acquire conceptual knowledge of Industrial relations and labour laws followed within industries.

CO2: Develop the greater understanding of IR concepts and its application in solving various issues in IR.

CO3: Analyze IR and labour laws concepts in various industries in India.

CO4: Interpret the application of Labour Legislations

CO5: Develop practical experience related to labour legislations in India across various sectors

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Industrial Relations and Labour Laws for Managers | Parul Gupta | Sage Publication India Pvt. Ltd | 2019 |
| 2 | The SAGE Handbook of Industrial Relations | Paul Blyton, Edmund Heery, Nicolas Bacon, Jack Fiorito | SAGE Publications | 2008 |
| 3 | Labour and Industrial Laws | P. K. PADHI | Prentice Hall India Pvt., Limited | 2017 |
| Reference Books | | | | |
| 1 | Bare Acts, Ministry of Labour | GOI | GOI | 2019 |
| 2 | The Idea of Labour Law | Guy Davidov, Brian Langille | The Oxford University Press | 2011 |
| 3 | Labour and Industrial Laws | PADHI, P. K | PHI Learning Pvt. Ltd | 2019 |

**SEMESTER: III**
**Course Name: Human Resource Audit**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR306** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basic Knowledge of HR concepts
- Importance of Audit function in the organizations
- Importance of Organization Development

**Module – 1 Introduction** **08 Hours**

| |
|---|
| HRD-Strategies and Systems; HR as Strategic Partner; HR Policies and Practices, Understanding HR system, Role of HR Manager in HRD, Elements of good HRD, Identifying HR competencies Meaning and Importance of HR Auditing, Benefits, Scope of Human Resource Audit , Components of HRD Audit |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Analyzing the components of HR Audit in different Industries |

**Module - 2 Conceptual understanding of HR Audit** **08 Hours**

| |
|---|
| Conceptualizing of Human Resource Audit, , The Audit system, Advantages and challenges, Identifying the Human Resource Audit Goal, Defining the Audit Team, Approaches to measuring HR Audit, Benefits, Competencies required for HR conducting HR Audit, HR Audit strategies, Strategic Alignment of HR audit |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on Goals of HR audits and its strategic alignment of various companies |

**Module – 3 HR Audit Process** **08 Hours**

| |
|---|
| Methodology of HR Audit: Introduction, Conducting a Human Resource Audit, Preliminary Steps, Planning questions; Interview; Observation; Questionnaire; Collecting Audit data; Analyzing and interpreting data; Assessing organization ability to change; Credibility building of HR Dept.; Internal - External Audit, Issues in HR Audit, Post Audit steps-Action Plan; HR Audit Report: Purpose, Report Design – Preparation of report, Use of HR Audit report for business improvement , |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Reviewing articles on HR audit to identify the components for developing questionnaire for audit process |

**Module – 4 Areas of HR Audit & HR Score Card** **08 Hours**

| |
|---|
| Audit of HR Planning; Training and Development; Industrial & Employee Relations; *HR* Audit as Intervention: Introduction, Effectiveness of Human Resource Development Audit as an Intervention, Human Resource Audit and Business Linkages; HR Scorecard: Introduction, Components of HR Scorecard, Framework of HR Scorecard, Usage of HR Score card in HR auditing, Human Resource Scorecard Design, Measuring Human Resource Effectiveness through HR Score card, Balanced Scorecard |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Application of HR scorecard in organizations |

**Module – 5 HR Audit for legal compliance and safe Business practices** **08 Hours**

| |
|---|
| Using scorecard approach in formulating workplace policies; Recruitment and Selection: Formulating FIR Audit for Start-up companies; HR Audit in practice: Cases in manufacturing industry, Service industry. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Analyzing case studies on HR audit in different Industries |

**Course Outcomes:**

CO1: To Gain conceptual knowledge and practical experience in understanding the HR Audit.
CO2: Analyze the strategic approaches to HR Audit aspects
CO3: Develop knowledge and apply the concepts of HR Audit in the organization
CO4: Elaborate better understanding of HR Audit concepts, policies and practices applied in the organization
CO5: Critically analyze the impact of HR Audit on the contemporary issues in the organization

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | HRD Audit: Evaluating the Human Resource Function for Business Improvement | TV Rao | Sage Response | 2/e, 2014 |
| 2 | HR Audit, Durdana Ovais | Rajni Gyanchandani | Everest Publishing House | 2017 |
| 3 | The HR Scorecard: Linking People, Strategy and Performance | | Harvard Business Review Press | 1/e, 2001 |
| | Human Resource Function: Audit | Peter Reiley | ABE Books | 1999 |
| Reference Books | | | | |
| 1 | Auditing your Human Resource Department | John McConnell | AMACOM | 2/e, 2011 |
| 2 | HRD Score Card 2500: Based on HRD Audit, | TV Rao | Sage Response | 1/e, 2005 |
| 3 | 7 Easy Steps to Conduct a Human Resources Audit and Protect Your Company! | Vanessa Nelson | Lulu Publication | 2016 |

# GUIDELINES FOR INTERNSHIP 22MBAIN307
# (BETWEEN 2ND AND 3RD SEMESTER MBA)

| INTERNSHIP | | | |
|---|---|---|---|
| Course Code | **22MBAIN307** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:8** | SEE Marks | **50** |
| Credits | **04** | Exam Hours | **00** |

**COURSE OBJECTIVE:**

1. To expose the students to understand the working culture of the organization and apply theoretical concepts in real life situation at the work place for various functions of the organization.
2. To build the ability in the student to identify the challenges faced by various organizations.
3. To make them understand the workflow models and the structure of the organization.
4. To help them implement various strategic marketing models on the organizational operations.
5. To gain the knowledge of overall organizational strategic & financial performance in tandem with societal benefits.

**STRUCTURE:**

The Internship shall consist of study of an organization for 4 credits for 4 weeks.

**GENERAL GUIDELINES:**

- The Internship shall be for a period of 4 weeks immediately after the completion of 2nd Semester Examinations but before the commencement of the 3rd semester classes. Copies of the Internship report should be sent to the concerned COE Office, Ballari Institute of Technology & Management, Ballari with intimation to the COE.
- The Course code of the Internship shall be 22MBAIN307 and shall be compulsory for all the students.
- No two students of an institute shall work on the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance. Student need to identify an external guide (Working in the organization) and seek guidance from him/her.

**Submission of Report:**

Students shall submit one hardcopy of the report to the college with hard bound color of royal blue and a softcopy in PDF file (Un-editable Format).

**Evaluation:**

Internal evaluation will be done by the internal guide.

**Viva-Voce/Presentation:**

A viva-voce examination shall be conducted at the respective institution where a student is expected to give a presentation of his/ her work. The viva –voce examination will be conducted by the respective HOD or Senior Professor or Internal Guide of the department and an external evaluator drawn from industry. In case of non-availability of industry professional, a senior professor or a faculty with more than 10years of experience may be invited to conduct the viva-voce examination. Internship carries 100 marks consisting of 50 marks for Internship report (evaluated by internal guide) and 50 marks for viva-voce examination (evaluated by guide & external examiner).

**Contents of the Internship Report:**

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution (scanned copy) indicating bonafide performance of Internship by the student.
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs

**Executive summary**

**Chapter1:** Introduction about the Organization & Industry.

**Chapter2:** Organization Profile

- I. Background,
- II. Nature of business,
- III. Vision mission, quality policy
- IV. Workflow model
- V. Product/service profile
- VI. Ownership pattern
- VII. Achievements/awards if any
- VIII. Future growth and prospects

**Chapter3:** Mckensy's7S framework and Porter's Five Force Model with special reference to Organization under study.

**Chapter4:** SWOT Analysis

**Chapter5:** Analysis of financial statements

**Chapter 6:** Learning Experience

**Bibliography:**

Annexure relevant to the Internship such as figures, graphs, photographs, financial statements etc.

**Format of the Internship:**

1. Report shall be prepared using the word processor viz., MS Word.
2. Times New Roman font sized 12
3. Page layout of A4 size with 1" margin all sides (1.5" on left side due to binding) and 1.5line spacing
4. The Internship report shall not exceed 60 pages

**Rubrics for Internship 22MBAIN307 Marks**

| SN | | Particulars | Marks |
|---|---|---|---|
| 1 | CIE | Assessment by the Guide-Interaction with the student by seminar, etc. | 25 |
| 2 | CIE | Report Evaluation by the Guide | 25 |
| 3 | SEE | Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/Institute | 50 |
| | | **Total** | **100** |

**Ballari Institute of Technology & Management, Ballari**
**(Autonomous Under VTU)**

**Mark sheet for Viva-Voce Examination (SEE)**
**Name of the Institution**
**Name of the Department**

**Course Code: 22MBAIN307**
**Course Title: Internship**

| SN | Aspects | Marks |
|---|---|---|
| 1 | Introduction and understanding the industry | 05 |
| 2 | Understanding the Corporate Functions/Company profile | 10 |
| 3 | McKenzie's 7S framework and Porter's Five Force Model | 10 |
| 4 | SWOT/SWOC analysis justification | 10 |
| 5 | Financial statement analysis | 05 |
| 6 | Learning experience | 10 |
| | **Total** | **50** |



**Marks Sheet for Viva Voce examination**

| SN | USN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| | **Total** | | | | | | | | **50** |

Signature of Internal Examiner
Name and Designation with affiliation

Signature of External Examiner
Name and Designation with affiliation

**Semester: III**

**Course Name: Aptitude Skill (Mandatory Non-Credit Course)**

| | | | |
|---|---|---|---|
| Course Code | **22MBAAT308** | CIE Marks | **100** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **-** |
| Credits | **---** | Exam Hours | **01** |
| Total Hours of Pedagogy | **30** | Max Marks | **100** |

**Pre-requisites:**

- Knowledge of Basics in Numerical
- Basics of Verbal and non-verbal Reasoning
- Basics of English Grammar

**Module – 1: Numerical Ability** **06 Hours**

| |
|---|
| Squares and square roots, Cubes and cube roots, Ratio and proportion, Percentages, Averages, Profit and Loss, SI, CI10 |
| Teaching-Learning Process: |
| Pedagogy: Lecture Method |

**Module – 2 Time Based and Permutation Based Problem Solving** **06 Hours**

| |
|---|
| Time and distance, Trains, Boats and streams, Time and work, Pipes and cisterns, Permutations, Combinations, Probability |
| Teaching-Learning Process: |
| Pedagogy: Lecture Method |

**Module – 3Analytical & Verbal Reasoning** **06 Hours**

| |
|---|
| Clocks & Calendars, Number series, Letter series, Directions, Coding and decoding, Blood relations, Venn diagrams, Classification, Syllogism, Analogy |
| Teaching-Learning Process |
| Pedagogy: Lecture Method |

**Module – 4 Data Analysis** **06 Hours**

| |
|---|
| Data interpretation, Data sufficiency, Mensuration, Grammar for spotting errors and sentence correction, Concepts for Sentence completion and passage completion |
| Teaching-Learning Process: |
| Pedagogy: Lecture Method |

**Module – 5 Communicative English** **06 Hours**

| |
|---|
| Vocabulary for Synonyms, Antonyms and one-word substitutions, Effective structures (for e-mail writing and essay writing), Reading comprehension and sentence rearrangement / Para jumbles. |
| Teaching-Learning Process: |
| Pedagogy: Lecture Method |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the skills related with Numerical Ability
CO2: Able to analysis for emulate with Time based, Permutation
CO3: Apply acquainted with Analytical and verbal reasoning
CO4: Analyse with the data
CO5: Ability to profound with communication English

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3 | 60% | 60 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3 | 40% | 40 |
| | **Total Marks** | | | **100** |

*There is No **SEE** exam

**Semester: IV**
**Course Name: R Programming For Managers**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA401** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Hadoop** **05 Hours**

| |
|---|
| Hadoop Distributed File System Basics, Running example programs and benchmarks, Hadoop MapReduce Framework, MapReduce programming. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module –2 Introduction to R** **08 Hours**

| |
|---|
| Numeric, Arithmetic, Assignment, and Vectors: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments, Logical expressions.<br>Matrices: Defining a Matrix, Sub, setting, Matrix Operations, Applying Functions to Matrix Rows and Columns,<br>Conditions and Looping: if statements, looping with for, looping with while, vector based programming |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 3** **08 Hours**

| |
|---|
| Higher Dimensional arrays: lists – Creating lists, General list operations – Accessing list components and values, applying functions to lists, recursive lists.<br>Creating Data Frames, Matrix, like operations in frames, Merging Data Frames, Applying functions to Data frames, Factors and Tables, factors and levels, Common functions used with factors. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 4** **08 Hours**

| |
|---|
| Control statements : Arithmetic and Boolean operators and values, Default values for arguments, Returning Boolean values, functions are objects, Environment and Scope issues<br>Recursion: Replacement functions, Tools for composing function code, Math and Simulations in R Creating Graphs, Customizing Graphs. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 5** **08 Hours**

| |
|---|
| Interfacing R to other languages, Parallel R, Basic Statistics, Linear Model, Generalized Linear models – Non, linear models, Time Series and Auto, correlation, Clustering |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Illustrate the basics of hadoop file system.
CO2: Demonstrate the importance of data mining techniques in business objectives.
CO3: Analyse the importance of business analytics and its applications using R programming.
CO4: Interpret data manipulation techniques using R programming.
CO5: Apply data visualization techniques in business objectives.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3, 4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | "Hadoop 2 Quick, Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem" | Douglas Eadline | Pearson... | 1st Edition, |
| 2 | "The Art of R Programming: A Tour of Statistical Software Design" | Norman Matoff | No Starch Press, | 2011. |
| Reference Books | | | | |
| 1 | "R for Everyone: Advanced Analytics and Graphics", | Jared P. Lander | Addison, Wesley | Addison, Wesley Data & Analytics Series, 2013 |
| 2 | " Beginning R – The Statistical Programming Language" | Mark Gardener | Wiley, | 2013 |
| 3 | "Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R" | Robert Knell | Amazon Digital South Asia Services Inc., | 2013 |

**Semester: IV**
**Course Name: Project Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA402** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Introduction to Project Management** **08 Hours**

What is Project Management? Relationship Between Project Management, Operations Management, and Organizational Strategy. Operations and Project Management. Organizations and Project Management.
**Role of the Project Manager:** Responsibilities and Competencies of the Project Manager. Interpersonal Skills of a Project Manager.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 2 Organization Influence & project Life cycle** **08 Hours**

Organizational Cultures and Styles. Organizational Structures. Composition of Project Teams. Project **Life Cycle:** Characteristics of the Project Life Cycle. Project Phases.
**Project Management Process Groups:** Planning Process Group. Executing Process Group. Monitoring and Controlling Process Group Closing Process Group.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 3 Project Time Management** **08 Hours**

**Schedule Management:** Inputs, Tools and Techniques & output.
**Define activities:** Inputs, Tools and Techniques & output.
**Sequence Activities:** Inputs, Tools and Techniques & output.
**Estimate Activity resources:** Inputs, Tools and Techniques & output.
**Estimate Activity Duration:** Inputs, Tools and Techniques & output.
**Develop Schedule:** Inputs, Tools and Techniques & output.
**Control Schedule:** Inputs, Tools and Techniques & output.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 4 Project Cost & Quality Management** **08 Hours**

**Plan Cost Management:** Inputs, Tools and Techniques & output.
**Estimate Cost:** Inputs, Tools and Techniques & output.
**Determine Budget:** Inputs, Tools and Techniques & output.
**Control Costs:** Inputs, Tools and Techniques & output.
**Project Quality Management:** Inputs, Tools and Techniques & output. Performance Quality Assurance: Inputs, Tools and Techniques & output.
**Control Quality:** Inputs, Tools and Techniques & output.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 5 Project Stakeholder Management** **08 Hours**

| |
|---|
| **Identify Stakeholders:** Inputs, Tools and Techniques & output.<br>**Plan Stakeholders Management:** Inputs, Tools and Techniques & output.<br>**Manage Stakeholders Engagement:** Inputs, Tools and Techniques & output.<br>**Control Stakeholders Engagement:** Inputs, Tools and Techniques & output. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Define the high professional standards of practice for project manager

CO2: Identify the key activities in the project life cycle.

CO3: Explore appropriate methods to initiate, plan and execute projects

CO4: Examine the scope, time, cost and quality of projects.

CO5: Analyze the stake holder expectations and engagement using suitable techniques.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3, 4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | A Guide to the Project Management Body of Knowledge | | Project Management Institute | Global Edition 5, 7 |

**Semester: IV**

**Course Name: Enterprise Resource Planning**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA403** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **3:0:0** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 ERP – A Curtain Raiser** **08 Hours**

| |
|---|
| An Overview, Accommodating variety, Integrated Management Information, Seamless Integration, Supply Chain Management, Resource Management, Integrated Data Model, Scope, Technology, Benefits of ERP. Evolution, ERP Revisited, ERP & the Modern Enterprise, Problems. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module –2 Business Engineering & ERP** **08 Hours**

| |
|---|
| An Overview, What is Business Engineering, Significance of Business Engineering, Principles of Business Engineering, BPR, ERP and IT, Business Engineering with Information Technology, ERP & Management Concerns, Business Modelling for ERP, Building the Business Model, Problems. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 3 ERP Implementation** **08 Hours**

| |
|---|
| Role of Consultants, Vendors & Users, Customization, Precautions, ERP Post Implementation Options, ERP Implementation Methodology, Guidelines for ERP Implementation, Problems. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 4 ERP Domain** **08 Hours**

| |
|---|
| The ERP Domain, MFG/PRO, IFS/ Avalon, Industrial & Financial Systems, Baan IV, SAP 82, SAP R/3 Applications, Example of an Indian ERP Package, The Arrival of ERP III, Problems. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 5 ERP and Competitive Advantage** **08 Hours**

| |
|---|
| ERP and the Competitive Strategy, Problems.<br>Marketing of ERP, Market Dynamics and Competitive Strategy, Problems. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Ability to understand and analyse various components of ERP

CO2: Develop ERP model to solve business problems.

CO3: Apply ERP implementation techniques to create solutions for business.

CO4: Demonstrate various packages related to different areas of business.

CO5: Analyse the strategic options for ERP identification and adoption.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3, 4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Enterprise Resource Planning | Vinod Kumar Garg, N.K Venkitakrishnan | Prentice hall of India. | 2nd edition 2004. |

**Semester: IV**
**Course Name: Peoples Analytics**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA404** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Pre-requisites:**
- Analytical skills
- Statistical Proficiency
- Good Decision Making skills
- Logical Reasoning
- Knowledge on HR concepts

**Module, 1 Introduction to Peoples Analytics** **08 Hours**

| |
|---|
| Introduction to People Management, Application of Analytics in Managing HR, Important definitions, Genesis of People analytics, importance, benefits and, skills needed for people analytics, future of people analytics, alignment of HR Analytics with business goals and strategy application of People Analytics to critical HRM functions for decision making, People Analytics framework and models. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 2 Peoples Analytics and Data** **08 Hours**

| |
|---|
| HR Data and Data Quality, HR Data Collection, Big Data for HR, Transforming HR Data in to HR Information, Process of Data Collection for HR Analytics, Data collection for effective HR Measurement, Levels of HR Analysis, Meaning of HR value Proposition, Measuring HR value proposition with People Analytics: Value proposition and HR decisions, Performing Root cause analysis, Datafication of Human Resources. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 3 HR Metrics and its Application** **08 Hours**

| |
|---|
| HR Metrics: Meaning, Types: Recruitment & Selection Metrics; Training & Development Metrics; Staffing Metrics; usage of Analytics in Performance appraisal, Talent Management & Compensation Management, Expatriate Management, Performance Metrics at Organizational level, HR Dashboards; HR Scorecard. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 4 Application of Analytics in Data Visualization** **08 Hours**

| |
|---|
| Dashboards: Few Key Excel Add, ins/Functions to Help Create Dashboards, Name Range, The Developer Tab, Form Controls, Important Excel Formulas Useful for Creating Dashboards, VLOOKUP, INDEX, SUMIF, AVERAGEIF and COUNTIF.<br>Introduction of Data visualization tools such as Tableau, Ploty, Click view and Fusion Charts.<br>Application of Tableau in HR Data Visualization: Tablueau Desktop, Tableau for Academicians, Menu options, Toolbar Description, Dimensions & Measures, Creating Dashboards in Tableau. |

| |
|---|
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Module – 5 HR Predictive Modeling** **08 Hours**

| |
|---|
| Correlation & Regression: Correlation Analysis, Simple Linear & Multiple Regression Analysis, Interaction Effects. Comparison of Means and ANOVA, One, Sample T, test, Null and Alternate Hypotheses, Paired Sample T, Test, Independent, Sample T, Test, Analysis of Variance, Factor Analysis; Cluster Analysis.<br>Software for Statistical Analysis: MS, Excel, IBM, SPSS, IBM, AMOS, SAS, and R programming<br>Case study: HR Predictive Modeling; Predictive Analytics Tools & Techniques, Conducting Hypotheses testing using Statistical Software. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Demonstrate the data driven decisions using statistical techniques
CO2: Interpret the basic analytical frameworks to aid strategic business decisions.
CO3: Analyze the people data to facilitate soft skill decision about hiring & talent development.
CO4: Make use of data analysis & visualization tools to deliver informed decision.
CO5: Identify potential business opportunities and risks using data patterns.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3, 4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | HR Analytics, Connecting Data and Theory | Rama Shankar Yadav Sunil Maheshwari | WILEY, India | 2021 |
| 2 | Practical Applications of HR Analytics 2019 | Pratyush, Banerjee; Jatin Pandey; Manish Gupta | SAGE Texts, India | 2019 |
| 3 | HR Analytics, Understanding Theories and Applications | Bhattacharya, Dipak Kumar | SAGE Texts, India | 2017 |
| **Reference Books** | | | | |
| 1 | Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives and Improving Collaboration | Sesil James, C | Pearson, New Jersey | 2017 |
| 2 | Predictive Analytics, Mastering the HR Matrix, | Martin Edwards and Kirsten Edwards, | Kogan Page, | 2019 |
| 3 | Fundamentals of HR Analytics: A Manual on Becoming HR Analytical | Fermin Diez, Mark Bussin, Venessa Lee, | Emerald Publishing Limited | 2019 |

**Semester: IV**
**Course Name: Business Intelligence**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA405** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Business Intelligence from Business Side** **08 Hours**

Business Intelligence by other names. How Business Intelligence provides business value. The Business Intelligence market. Operational and source systems. Data transfer from operational to data warehouse. The data warehouse, data warehouse tables. The data warehouse technology platforms. Best practices for successful business intelligence

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 2 The Business Intelligence front, end** **08 Hours**

Business query and reporting. Production reporting. Online Analytical Processing (OLAP) Microsoft office Dashboards, Scoreboards, Performance Management, Analytic applications, Emerging BI modules. Success and business impact. How to measure Success? Return on Investment.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 3 The LOFT effect** **08 Hours**

The LOFT effect. Role of Luck. Opportunity. Frustration. Threat. The role of time. If there is no LOFT effect, Is successful BI still possible? Best practices for successful business intelligence.
D is for data. Data quality. Successful data architectures. Master data management (MDM). Right time data. Data quality's chicken and egg.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 4 The Right BI tool for the right user** **08 Hours**

The importance of BI tools. The role of BI standardization. The Right BI tool for the right user. The most successful BI module. Best practices for successful Business intelligence.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Module – 5 Secrets to Success & the future of Business Intelligence** **08 Hours**

The role of Culture. Promoting your BI capabilities. Training. A picture is worth a thousand numbers. Emerging technologies. Predicting future. BI search & Text Analytics. Advanced visualization. Rich Report lets. The Future beyond technology. Words of wisdom.

Teaching, Learning Process:

Pedagogy: Lab and Lecture Method.

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Apply various concepts of BI to provide solutions to the business.
CO2: Demonstrate various analytical tools on the data to solve business problems.
CO3: Demonstrate the best practices for successful implementation of BI.
CO4: Choose appropriate BI tool to solve the business problems.
CO5: Elucidate the BI capabilities to perform analysis and reporting of data.

**Assessment Details**

Continuous Internal Evaluation (CIE):

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3, 4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Successful business Intelligence: secrets to making BI a killer app | Cindi Howson | Mc Grew hill | 2007 |
| **Reference Books** | | | | |
| 1 | Business Intelligence Road Map | Larissa T.Moss Shaku Atre | Addison Wesley | 2003 |

**Semester: IV**
**Course Name: Corporate Social and Web Analytics**

| | | | |
|---|---|---|---|
| Course Code | **22MBADA406** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Total Marks | **100** |

**Module – 1 Social Media Data** **08 Hours**

Foundation for Analytics, A Look into the Evolution of Data and the Digital Gap, Social Media Data Sources: Offline and Online, Defining Social Media Data, Data Sources in Social Media Channels, Estimated vs. Factual Data Sources, Social Media Network Support of Data Collection, API: Application Programming Interface.
From data to insights: Shaping Data to Work for Us, Creating a Plan to Shape Data into Insights A Glimpse into the Analysis: The Process of Comparison.
Analytics in Social Media: Defining a Very Broad Term, Types of Analytics in Social Media: Analytics, Listening, Advertising Analytics, Analytics from CMS and CRM
Dedicated Vs. Hybrid tools: What Are They? Which Are Best? The Advantages of Dedicated Tools, The disadvantages of Dedicated Tools. Data Integration Tools.

Teaching, Learning Process:
Pedagogy: Lab and Lecture Method.

**Module –2 The Analytics Process** **08 Hours**

Elements to Shape Data Insights, The Analysis Cycle: Time Periods as the First Key to Comparison. Armando Terribili.
Metrics, dashboards and reports: Metrics, The Basis for Analysis, Metrics and Strategy: Selecting the Best Metrics for the Job. Dashboards, More Than a Collection of Metrics, Dashboard Purpose, Default vs. Custom Dashboards, The Essence of a Good Dashboard, Reports, The Key to Analytics Success, Reporting Approaches, Animation and Effects in Reporting, Reporting with Teams, The Report as a Key to Success.

Teaching, Learning Process:
Pedagogy: Lab and Lecture Method.

**Module – 3 Web Analytics: Present and Future** **08 Hours**

History of Web Analytics, current landscape and challenges, What web analytics should do?
Data Collection: Understanding data landscape, clickstream data, outcomes data, research data, competitive data.

Teaching, Learning Process:
Pedagogy: Lab and Lecture Method.

**Module – 4 Overview of Qualitative Analysis** **08 Hours**

Lab usability testing, Heuristic evaluations, site visits, surveys, focus on customer centricity, solve for business questions, follow the 10/90 rule.

Teaching, Learning Process:
Pedagogy: Lab and Lecture Method.

**Module – 5 Web Analytics Fundamentals** **08 Hours**

| |
|---|
| Capturing data, selecting your optimal web analytics tool, understanding clickstream data quality, implementing best practices. |
| Teaching, Learning Process: |
| Pedagogy: Lab and Lecture Method. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Utilize API services to collect data from different social media data sources
CO2: Derive insights from processed data using suitable metrics and reporting methods.
CO3: Explain the role of web analytics within the digital marketing landscape
CO4: Make use of Heuristic evaluation & web intelligence to solve business problems.
CO5: Demonstrate the best practices in web analytics for potential business growth

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3, 4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Social Media Analytics Strategy, Using Data to Optimize Business Performance | Alex Goncalves | Springer Science, New York | 2017 |
| 2 | Web Analytics, An Hour A Day | Avinash Kaushik | Wiley Publications | May 2007 |

**Semester: IV**

**Course Name: Port and Airport Management for Logistics**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS401** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**

- Basic knowledge of port and airport management.
- Basics of logistics and supply chain.
- Awareness of port and airport services

**Course objectives:**

1. To familiarize with port structure, airports shipment and operations.
2. To learn Port operations and air cargo.
3. To understand the Airport management for logistics.
4. To administer the port ownership structure from Indian and global context.
5. To know the airport transportation modes for better handling of airport cargo.

**Module 1 – Port Structure & Airports Shipment 08 Hours (RBT Levels: L1, L2, L3)**

1. History of Ports in International Trade;
2. Role of Ports;
3. Port Infrastructure and connectivity;
4. Port Structure and Functions: Definition-Types and Layout of the Ports,
5. Organizational structure-Fundamental observations;

6. & 7. Main functions and features of ports: Administrative functions-Operational functions.

8. Air Ports and Shipment: Ground Handling Agencies;
9. Advantage of Air shipment- Economics of Air Shipment;
10. Sensitive Cargo by Air shipment- Do's and Don'ts in Air Cargo Business. Air Craft (moved to Module 3).

Teaching-Learning Process:

Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study

Skill Enrichment Exercises: Study the different ports and airports and mention the different functions and features.

**Module 2 – Port Operations & Air Cargo 08 Hours (RBT Levels: L1, L2, L3, L4)**

1. Port Operations: Berths and Terminals;
2. Berth Facilities and Equipment-Ship Operation;
3. Pre-shipment planning, the stowage plan and on-board stowage; Cargo positioning and stowage on the terminal;
4. Developments in cargo / container handling and terminal operation;
5. Safety of cargo Operations, Cargo security;
6. Measuring and evaluating performance and productivity;
7. Air Cargo: Air Cargo Console; Freighting of Air Cargo;
8. Volume based Calculation of Freight-Weight based Calculation of Freight; Importance of Import and Export Documentation; Handling of documents in Ports.

Teaching-Learning Process: Students should study the various operations of port and air cargo and prepare a report.

| |
|---|
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Student should consider few ports and draft the flow chart of the shipment process. |

**Module 3 – Port Development & Airway Bills** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| 1. Port Development: Phases of port development;<br>2. Growth and changes in word trade and resultant changes in growth and development in terminal operation;<br>3. Shipping technology and port: Ship knowledge – Ship development and port development-Port time and ship speed;<br>4. Aircraft knowledge; Types of Aircrafts; Differences between Passenger and Cargo Aircrafts;<br>5. Airports growth and development with particular reference to cargo logistics;<br>6. Role of various organizations in Air freight management;<br>7. IATA - History of IATA - Mission of IATA - Price setting by IATA -Licensing of Agencies; FIATA and other organizations;<br>8. Airway Bills: their importance and handling processes. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentations, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students should prepare a report on port development strategies with few examples. |

**Module 4 – Port Administration Owner** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| 1. Governance of Ports;<br>2. Port Administration Ownership and Management;<br>3. Port ownership structure –Types of port ownership and administration; Port ownership structure in India;<br>4. Organizations concerning ports; Boards governing the ports;<br>5. Port management development;<br>6. Rise and fall of Ports;<br>7. Information technology in ports;<br>8. Port ownership in Indian context: Acts governing the Ports in India. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentations, YouTube videos, Case Study<br>Skill Enrichment Exercises: Live case study on air cargo. |

**Module 5 – Air Transportation & DG Air Cargo** **08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| 1. Air Transport: Introduction to Air Transport;<br>2. Air Freight and Cargo Handling at Air Port;<br>3. Information Management of Air Cargo – System and Modules;<br>4. Airside and Land side handling of goods;<br>5. Air cargo handling equipment; Distribution of Goods<br>6. DG Air Cargo and its role in Air Freight transportation and control;<br>7. Classification and labeling of Cargo; Types of Labels according Cargo-Samples of Labels;<br>8. Packing and Transportation of Goods by Air. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk method, YouTube videos, PowerPoint Presentations<br>Skill Enrichment Exercises: Case study on air transportation and freights. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Application of process of Port and Air Management for Logistics operations.

CO2: Analyze the various activities involved in port operations and air cargo for the appropriate shipping of goods.

CO3: Evaluate the port management system for integrating the various logistics operations.

CO4: Comprehend the various port facilities and structures for better shipment of goods & services.

CO5: Communicate the different processes and documentations by air and cargo transportation for optimized handling of goods and services.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Port Management and Operations. | Patrick M.Alderton | Information Law Category, U.K. | 2008 |
| 2 | Air Cargo Management | Yoon Seok Chang | CRC Press | 2015 |
| **Reference Books** | | | | |
| 1 | Port Reform Tool Kit | WORLD BANK | World Bank, Washington | 2007 |
| 2 | Air cargo distributions: a management analysis of its economic and marketing benefits | Paul | Jackson and William Brackenridge | (Gower Press), 1988. |
| 3 | Port Management and Operations | MARIA G.BURNS | CRS Press, U.K. | 2014 |

**E-Resources:**

http://www.wiam.in/courses.html
https://alison.com/course/transport-management-in-the-uk-road-rail-waterways-ports-and-airports
https://www.iata.org/en/training/subject-areas/cargo/
https://www.udemy.com/course/aviation-logistics-in-import-export-supply-chain-of-cargo/
https://collegedunia.com/courses/airport-management
https://www.altexsoft.com/blog/travel/airport-technology-management-operations-software-solutions-and-vendors/
https://www.civilaviation.gov.in/sites/default/files/moca_001669.pdf

**Semester: IV**
**Course Name: Global Supply Chain Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBALS402** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basics of logistics and supply chain
- Awareness of distribution channel and material handling.
- Knowledge of supply chain in global prospective

**Course objectives:**
1. Understand the strategic role of distribution & logistics management globally.
2. Gain knowledge in global logistics and risk management globally.
3. Study the important modes of distribution control and evaluation.
4. Teach the supply chain techniques in an international perspective.
5. Identify the performance evaluation techniques and its implementation.

**Module 1 – Distribution Management & Global Logistics 08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| 1. Need for physical distribution–functions of distribution– marketing forces affecting distribution.<br>2. Global purchasing trends;<br>3. Purchas in global supply chain–critical success factors;<br>4. Global Logistics: Introduction–Global Logistics Meaning and Definition and Importance;<br>5. Global market forces – Factors Influencing Global Market Forces – Factors Influencing;<br>6. Technological Forces –Global Cost Forces; 8. Political and Economic Forces. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students should choose logistics firms and identify the critical success factors and external influencing factors for the same. |

**Module 2 – Distribution Channel & Risk Management in Global Scenario**
**08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| 1. Channels of distribution: role of marketing channels – channel functions;<br>2. Channel structure: Domestic and Global;<br>3. Designing distribution channel – choice of distribution channels – factors affecting;<br>4. Stakeholders and Intermediaries: functions of intermediaries – types of intermediaries<br>5. Variables in selecting channel members – motivating – training;<br>6. Evaluating channel members – modifying channel arrangements;<br>7. Risk Management in distribution – Meaning and Definition, Introduction to Global Risks;<br>8. Managing Global Risks. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Student should overview and draft the comparative analysis of 2 company's channels of distribution. |

**Module 3 - Distribution control & Evaluation 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| 1. Distribution control–stages of control process–standards & goals;<br>2. Performance report – measurement;<br>3. Monitoring and taking corrective actions; Metrics used;<br>4. Organization for Distribution: Distribution Organization structure;<br>5. Role of Private & Public organizations in distribution;<br>6. Conflict resolution in distribution –rising costs &need for control;<br>7. Complexities of physical distribution;<br>8. Performance Measurement and Evaluating Distribution Effectiveness and Efficiency. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentations, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students should evaluate the different conflicts in the distribution channel and suggest appropriate resolutions. |

**Module 4 – International SCM & Material Handling in Logistics**
**08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| 1. International Supply Chain Management: Introduction to International Supply chain;<br>2. Issues in International Supply Chain Management;<br>3. International versus Regional supply chain management;<br>4. Role of Material Handling in Logistics;<br>5. Material Handling Guidelines;<br>6. Material Handling Equipment and Systems – Automated Material Handling, Benefits of Logistics;<br>7. & 8. Outsourcing – Reasons for and advantages of Outsourcing – Third Party Logistics – Fourth Party Logistics – Fifth Party Logistics – Value Added Services. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentations, YouTube videos, Case Study<br>Skill Enrichment Exercises: Case study on outsourcing. |

**Module 5 – Performance Evaluation & Global Strategy Implementation**
**08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| 1. Performance Expectation & Evaluation;<br>2. Regional differences in Logistics; Cultural differences in different places;<br>3. Information system Availability, use of Geographic information Systems – Infrastructure and Processes;<br>4. Human Resources – role & significance;<br>5. Global Logistics and Supply Chain Strategy: Designing Global Strategy;<br>6. Requirements for Global Strategy;<br>7. Global Strategy implementation;<br>8. Miscellaneous Dangers in global strategy implementation. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk method, YouTube videos, PowerPoint Presentations<br>Skill Enrichment Exercises: Case study on global strategy implementation for distribution and SCM |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Apply the strategic role of Logistics and Supply chain Management in global operations.
CO2: Analyze the different distribution networks of the firms with global perspective.
CO3: Evaluate the varied distribution process to predict the control operations in SCM.
CO4: Comprehend the global SCM and suggest material handling systems for appropriate industries.
CO5: Communicate the cultural and global strategy of SCM in implementation and performance review.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
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**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Basics of Distribution Management: A Logistical Approach | Kapoor Satish K., and Kansal Purva | Prentice Hall of India | Latest Edition |
| 2 | Global Logistics & Supply Chain Management | John Mangan, Chandra Lalwani | Tim Butcher John Wiley & Sons | 2nd Edition, 2011 |
| **Reference Books** | | | | |
| 1 | Designing & Managing the Supply Chain | David Simchi, Levi, Philip Kaminsky, Ravi Shankar | Tata McGraw Hill | 14th Edition, 2010. |
| 2 | Distribution and Logistics Management: A Strategic Marketing Approach | D K Agrawal | Macmillan publishers India | Latest Edition |
| 3 | International Logistics: The Management of International Trade Operations | Pierre David | Paperback – Import | 1 Dec 2013 |

**E-Resources:**
https://www.london.ac.uk/courses/supply-chain-management
https://www.naukri.com/learning/articles/supply-chain-management-best-resources/
https://onlinecourses.swayam2.ac.in/cec22_mg15/preview
https://www.classcentral.com/course/swayam-supply-chain-management-14314
https://www.careers360.com/courses-certifications/swayam-logistics-and-supply-chain-management-courses-brp-org
https://nptel.ac.in/courses/110108056

**Semester: IV**
**Course Name: Export Import Management**

| | | | |
|---|---|---|---|
| Course Code: | **22MBALS403** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basic knowledge on International Trade
- Fundamental knowledge Cargo and Shipment process.
- Basic awareness of the national and international trade law

**Course objectives:**
1. To provide fundamental concepts of on the trade policy
2. To familiarize the fundamentals principles document of shipments
3. To teach the concepts of international Export- Import contract laws
4. To educate the importance of Terms of Payment
5. To emphasis on the concepts of Instruments of payment.

**Module – 1 Export-Import Trade: Introduction to Regulatory Framework**
**08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| 1. Introduction, trade policy, foreign trade;<br>2. History and Governance of Foreign Trade in India;<br>3. Role of DGFT;<br>4. Latest Foreign Trade Policy of India (2023); simplification in documentation (developments in august, 2005), DGFT related documentation at a single place, reduction of documents to five for customs purposes. (moved to Module 2) 4. Important Regulatory Bodies for International Trade;<br>5. Types of Import Export Businesses.<br>6. Preparing an export business plan;<br>7. ESTABLISHING A BUSINESS FIRM for export business: Basic Registrations;<br>8. DGFT related permissions and Registrations: And Registration with other Authorities. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are assigned to select a firm and reports of its registration. |

**Module – 2 Documentation Framework-Aligned Documentation System (ADS)**
**08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| 1. Simplification in documentation (developments in august, 2005), DGFT related documentation at a single place, reduction of documents to five for customs purposes(moved from Module 1);<br>2. Objective, advantages of aligned documentation system;<br>3. Documentation requirement situation today;<br>4. Categorization of Export Documentation;<br>5. Commercial documents: principal export documents, Auxiliary export documents;<br>6. Regulatory documents.<br>7. Classification of commercial and regulatory documents:<br>a. documents related to goods,<br>b. documents related to shipment; |

| |
|---|
| 8. Documents related to payment, document related to Inspection, documents related to Excisable Goods, and documents relating to Foreign Exchange. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are assigned to collect and present as assignment of Documents related to shipment documents related to payment for a selected firm. |

**Module – 3 International Business Contracts 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| 1. Introduction to Agreements and Contracts;<br>2. Distinction between domestic sales contract and export sales contract;<br>3. Conflict of laws in International Contracts;<br>4. Types of Export Contracts; Constructed contract;<br>5. Elements of Export Contracts;<br>6. Duties and responsibilities of Exporters and Importers in International Contracts;<br>7. Incoterms 2020,<br>8. Major laws having bearing on export contracts elements in export contracts. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentations, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are made to present different Incoterms of any choice of one company. |

**Module – 4 Legal dimensions and Terms of Payment 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| 1. Legal dimensions: a. relating to export-import contracts,<br>2. b. relating to relationships between exporter and agents/distributors, c. relating to products,<br>3. d. relating to letters of credit.<br>4. Introduction to Terms of Payment: factors that determine terms of payment,<br>5. Methods of receiving payment, Payment in advance documentary bills,<br>6. Documentary credit under letters of credit;<br>7. Different types of Letters of Credit;<br>8. Role of Banks and Financial Institutions in Export/Import Payments. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentations, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are made to present different Terms of Payment for any particular company |

**Module – 5 Instruments of Payment & Methods of Financing Exports**
**08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| 1. Introduction to Instruments of payment:<br>2. Pre-shipment finance: Packing credit;<br>3. Advances against incentives receivable from government;<br>4. Pre-shipment credit in foreign currency;<br>5. Post shipment: finance;<br>6. Negotiation of export documents under letters of credit, purchase/discount of foreign bills, advance against export bills sent on collection;<br>7. Legal bindings and factors that determine payment terms in International Business;<br>8. Various methods financing export / import business; Concessions and incentives available for export / import business in India |

| Teaching-Learning Process: |
|---|
| Pedagogy: Chalk and Talk method, YouTube videos, PowerPoint Presentations<br>Skill Enrichment Exercises: Students are assigned to draft and present Instruments of payment by selecting any one firm. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts domestic and foreign trade process for appropriate firms.
CO2: Analyze the different documentation for Export and imports trade process.
CO3: Evaluate the different kind of contractual agreement for the appropriate trade.
CO4: Design appropriate legal aspects and Terms of Payment in Exim trade.
CO5: Communicate the appropriate instruments and financing for export process.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

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- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Export and Import Procedures Documentation and Logistics | C Ram Gopal | New age International Ltd Publishers | 2008 latest edition<br>ISBN (10) : 81-224-2326-4<br>ISBN (13) : 978-81-224-2326-6 |
| 2 | Export Import: Procedure and Documentation | Sultan Ahmad | Sultan Chand & Sons | IstEdition2022<br>ISBN13: 978-81-951043-6-9 |
| Reference Books | | | | |
| 1 | Export/Import Procedures and Documentation | Thomas E. Johnson | Amacom | Amacom; 4th edition April2010<br>ISBN-10 : 0814415504<br>ISBN-13 : 978-0814415504 |
| 2 | Export Procedures and Documentation | SudhirKochhar | Gullybaba Publishing House | 2015<br>ISBN: 9789381970812, 9381970815 |

**E-Resources.**

https://egyankosh.ac.in/bitstream/123456789/12065/1/Unit-1.pdf
https://dokumen.tips/documents/aligned-documentation-system-ads.html?page=3
https://www.lumsa.it/sites/default/files/UTENTI/u601/Principles%20of%20International%20Commercial%20Contracts.pdf
https://egyankosh.ac.in/bitstream/123456789/12563/1/Unit-6.pdf
http://www.eximguru.com/exim/guides/export-finance/ch_1_payment_methods_in_export_import.aspx

**Semester: IV**
**Course Name: International Logistics Management**

| | | | |
|---|---|---|---|
| Course Code: | **22MBALS404** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basic knowledge on Logistic
- Fundamental knowledge Global Markets,
- Awareness of the basic economic trade process

**Course objectives:**
1. To provide students understand the issues in International Logistics
2. To familiarize the concepts of Sales Contract in International Logistics
3. To educate the Concepts integration of various Supply chain and Logistic Networks
4. To teach the concept international multimodal Transport Systems
5. To emphasis the concepts of cost &economic of International logistics.

**Module – 1 Foundation Concepts in International Logistics 08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Overview of International Logistics- Components, Importance, Objectives; Barrier to Internal Integration. Managing the Supply Pipeline for Global Trade Flows, The Global Logistics Operators, Comparison between National (Domestic) and International Logistics, International Transport, Globalization and International Trade Environment. Factors Driving Global Supply Chain Management, Customs and Global Supply Chain Management. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are requested present the concepts of environment. Factors driving international logistics. |

**Module – 2 Export Sales Contract in International Logistics**
**08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Constituents of the Export Sales Contract, Contract of Affreightment: Terms of Delivery &Incoterms standards. International Purchasing Systems, Constituents / Strategy and its Interface with the Management of the Global Supply Chain, Negotiating the Contract, Selecting the International Logistics Operator, Criteria of Selecting the Third-Party Logistics Operator. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are assigned to submitted the different Export Sales Contract |

**Module – 3 Integrating International Logistics with Supply Chain**
**08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Trade-Offs in International Logistics, Multi-Modalism, Key Factors in a Transport Mode(s) &<br>Trade-Off. Considerations of Speed, Frequency, Packing and Insurance in International Transportation.<br>Warehousing & Benchmarking in Global Supply Chain Management, Supply<br>Chain Cycle Time Reduction, Demand-Driven Supply Network in International Logistics. |
| Teaching-Learning Process: |

| |
|---|
| Pedagogy: Chalk and talk method, Power point presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are assigned to draft different internal warehousing management activities in different industry |

**Module – 4 International Transport Systems 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Introduction to International Transport System- Basic Terms, Characteristics and Relations, Significance of Transportation Services, Characteristics of Modes of Transports –Road Transportation, Rail Transportation, Maritime Transport, Air Transport. Intermodal Transportation, Technical performance & Transport Economic Indicators, Maritime Routing Patterns, The Containerization of Commodities, Transcontinental Bridges. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, Power point presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are assigned to submitted the draft of different International Transport modes used by company |

**Module – 5 Cost and Economy of International Logistics**
**08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| International Transport and Economic Development, Transportation and Commercial Geography International Transport Costs, International Transport Supply and Demand, Location Analysis, Market Area Analysis, The Nature of International Transport Policy, International Transport Planning, International Transport Safety and Security, Traffic Counts and Traffic Surveys, Cost /Benefit Analysis. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk method, YouTube videos, Power point presentations<br>Skill Enrichment Exercises: Students are assigned to present factors effecting the Cost and Economy of International Logistics of a two companies |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts of principles of international logistics Operation in appropriate sectors.
CO2: Analyze in different Export Sales Contract in Logistics operations
CO3: Evaluate the parameters for integrating the international Logistics and supply chain management
CO4: Design suitable modes of International logistic Transport system in the appropriate industry
CO5: Communicate the appropriate components of cost factors and Economic Development steps for the International Logistics

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | International Logistics | Pierre David | Wiley; | 1st edition<br>ISBN-10 : 8177224301<br>ISBN-13 : 978-8177224306 |
| 2 | International Logistics Management | Robert Chira | Authorhouse | 25 July 2016<br>ISBN-10 : 1524632082<br>ISBN-13 : 978-1524632083 |
| **Reference Books** | | | | |
| 1 | "The Geography of Transport Systems" | Jean-Paul Rodrigue, Claude Comtois and Brian Slack | Routledge, | (2009), New York: |
| 2 | "Intermodal Freight Requirements, " | LaLonde, Bernard J. | Macmillan | 8th Edition, |
| 3 | International Logistics: The Management of International Trade Operations | Pierre David | Cicero | 1 December 2013<br>4th edition<br>ISBN-10 : 0989490602<br>ISBN-13 : 978-0989490603 |

**E-Resources:**

https://bujhansi.ac.in/econtent/pages/shortcodes/ims/UNIT-3_I.LOGISTICS.pdf
https://egyankosh.ac.in/bitstream/123456789/14971/1/Unit-3.pdf
https://jqualityinnovation.springeropen.com/track/pdf/10.1186/s40887-020-00039-w.pdf
https://ftp.idu.ac.id/wp-content/uploads/ebook/ip/LOGISTIK%20TRANSPOTASI/Logistics%20Transportation%20Systems%20by%20MD%20Sarder%20(z-lib.org).pdf
https://repositorio.cepal.org/bitstream/handle/11362/44899/1/S1900718_en.pdf

**Semester: IV**
**Course Name: Containerization and Multimodal Transport**

| | | | |
|---|---|---|---|
| Course Code: | **22MBALS405** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basic knowledge on Supply Chain
- Fundamental knowledge marketing, production.
- Awareness of the manufacturing and trading process

**Course objectives:**
1. To provide insights on the concept and meaning of containerization
2. To familiarize the fundamentals of the Cargos in international trade
3. To emphasis the concepts of the Multi-modal Trade Routes
4. To educate the Concepts of the Physical multi modal operations
5. To teach the concept of contacts and documentation during shipping

**Module – 1 Basic Concepts of Containerization**

**08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Meaning - Major Container Trades - Container Operators - Container Ships - Terminal- Consideration of Container Terminal Planning - Container Distribution – Container types - ISO Container Dimension by types - Non- Containerisable cargo - Features of Containerization - Equipment for non-containerisable cargo. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment<br>Exercises: Students are assigned to draft assignment on different containers and the shipping process of containers |

**Module – 2 Cargo** **08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| International Trade Distribution - Stowage: Meaning - Stowage of cargo – Factor Consideration - Types of cargo - Characteristics - Cargo and Container handling equipment - Types of Packing- Marking of cargo - Dangerous Cargo - IMDG Code –Classes. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment<br>Exercises: Students are assigned different logistics company and asked to analyze with the shipping parameters. |

**Module – 3 Multi Modalism** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Multi-modal Trade Routes - Evolution – Basic Intermodal System - Modal Interface Factors outline why shipper favour Multi-modalism - Factors in Development Features -Multi-Modalism Strategy – Components. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are made to present different Multi-modal Trade Routes on air, water, road and rail. |

**Module – 4 Physical Multi Modal Operations** **08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Liners - Tramps - Specialized Vessels - Terms - Road transport vehicle – Road Transport Weight and Measurement - Rail Transport Vehicle and Equipment – Air Transport - Ports - LCL - FCL - NVOCC - Freight forwarders - Consolidator – ICD CFS- Free Trade Area - SEZ - Factors affecting mode and route choice. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and talk method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Students are made to present different mode of transportations of goods and highlight the advantages and the disadvantages of each Physical Multi Modal Operations of transportation |

**Module – 5 Contract** **08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| International contract of sale-Bill of Lading-Clauses-Way bills-Identity of Carrier-Liability and Insurance-Paperless Trading, Indian Multimodal Act- 1993, Conventions related Multi modal transport-Cargo liability conventions, Conventions relating Dangerous Goods-Cusms conventions-Statutory Regulations and Restrictions-National and International restrictions on the movement of goods. |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk method, YouTube videos, PowerPoint Presentations<br>Skill Enrichment<br>Exercises: Students are assigned to draft and present different types of contract in Logistics and supply chain management. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts of the containerization in logistics process.
CO2: Analyze the different International Trade Distribution in Logistics management.
CO3: Evaluate the various Multi-modal Trade Routes in the logistic system.
CO4: Design appropriate design for the multi-modal operations.
CO5: Communicate the appropriate contractual agreement in the Shipping Process

## Assessment Details

Continuous Internal Evaluation (CIE):

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Containerization, Multimodal Transport & Infrastructure Development In India, | K. V. Hariharan, | Shroff Publishers & Distributers Private Limited - Mumbai | 1st edition 8173665516 |
| 2 | Supply Chain Management- Strategy, Planning and Operation | Sunil Chopra, Peter Meindl, D.V.Kalra | Pearson | Latest edition |
| **Reference Books** | | | | |
| 1 | Transportation Engineering: An Introduction, | JotinKhisty C and Kent Lall B, | Prentice Hall International | 3rd edition 2002. |
| 2 | Principles of Urban Transport Systems Planning, | Hutchinson B.G, | McGraw-Hill Book Company | (Latest edition), 2013. |
| 3 | Branch's Elements of Shipping. | Alan E Branch & Michael Robarts (2014) | Routledge Publication. | 9th Edition, |
| 4 | Logistics and Multi-modal Transport. | Claus, Hyldager (2013) | Institute of Charted Shipbrokers. | 2013 Edition, |

**E-Resources:**

https://medium.com/geekculture/introduction-to-containers-basics-of-containerization-bb60503df931
https://porteconomicsmanagement.org/pemp/contents/part1/maritime-shipping-and-international-trade/
https://www.cevalogistics.com/en/for patients/?utm_source=Google&utm_medium=CPC&utm_campaign=Search-Healthcare India&gclid.
https://www.unescap.org/sites/default/d8files/event-documents/03MultimodalTransportationConceptAndFramework.pdf
https://unctad.org/system/files/official-document/dtltlbinf2022d1_en.pdf

**Semester: IV**
**Course Name: Supply Chain Information System**

| | | | |
|---|---|---|---|
| Course Code: | **22MBALS406** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |

**Pre-requisites:**
- Basics of Supply Chain.
- Fundamental knowledge of Communication Networks.
- Basics of Logistics.

**Course objectives:**
1. To provide insights on the concept and meaning of Electronic SCM, Communication Networks.
2. To familiarize the fundamentals of Enterprise Information Systems.
3. To emphasis the concepts of SCM Systems Development.
4. To educate the Concepts Deployment and Management.
5. To teach the concept of Information Integration.

**Module – 1 Electronic SCM, Communication Networks 08 Hours (RBT Levels: L1, L2, L3)**

| |
|---|
| Introduction eSCM- eSCM Framework - Key Success Factors for eSCM - Benefits of eSCM- Positioning Information in Logistics - Strategic Information Linkage - Supply Chain Communication Networks - Role of Communication Networks in Supply Chains - Overview of Telecommunication Networks –EDI - Data Security in Supply Chain Networks |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment<br>Exercises: Draft & Present the Communication Networks used in Supply Chain Management |

**Module – 2 Enterprise Information Systems 08 Hours (RBT Levels: L1, L2, L3, L4)**

| |
|---|
| Overview of Enterprise Information Systems - Information Functionality and Principles - Introduction Enterprise Information Systems -Classification of Enterprise Information Systems - Information Architecture -Framework for Managing Supply Chain Information - Describe ion on Popular Enterprise Application Packages -Benefits of Enterprise Information Systems |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: List out the best enterprise software & tools for sustainable business growth |

**Module – 3 SCM Systems Development 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Stakeholders in Supply Chain Information Systems - Stakeholders in SCM - Stakeholders in Supply Chain Information Systems - Information Systems Development- Logistics Information Systems Design- Defining Enterprise Architecture - Choosing Appropriate System Development Methodologies - Adopting Relevant Systems Development Model |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Draft & Present the 5 top companies that use enterprise architecture |

**Module – 4 Deployment and Management 08 Hours (RBT Levels: L2, L3, L4, L5)**

| |
|---|
| Information Systems Deployment - IT Operations and Infrastructure Management - Portfolio, Programme and Project Management - Management of Risk - Management of Value |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Draft & Present the best practices for managing a *Project* |

**Module – 5 Information Integration 08 Hours (RBT Levels: L3, L4, L5, L6)**

| |
|---|
| Enterprise Application Integration and Supply Chain Visibility - Enterprise Application Integration - Supply Chain Visibility - Supply Chain Event Management -Supply Chain Performance -Planning and Design Methodology - Problem Definition and Planning - Data Collection and Analysis - Recommendations and Implementation -Decision Support Systems |
| Teaching-Learning Process: |
| Pedagogy: Chalk and Talk Method, PowerPoint Presentation, YouTube videos, Case Study<br>Skill Enrichment Exercises: Plan and Design a methodology for Supply Chain Performance |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts of Supply Chain Management Communication Networks to solve the business problems.
CO2: Analyze Enterprise Information Systems.
CO3: Evaluate various information systems development methodologies.
CO4: Design various information system deployment methods.
CO5: Create new set of information for business decision making.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 2 | Business Logistics Management | R.H. Ballou, and Samir | Pearson Education | 5th Edition 2014 |
| **Reference Books** | | | | |
| 1 | E-Marketing | Strauss, Alexa & Frost | Routledge Tylor &rancis Group | 8th New edition 2018 |
| 2 | Statistics for Managers Using MS Excel | Levine & David | Pearson Education | 8th Edition, 2017 |
| 3 | Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management | David B. Grant & Chee Yew Wong | Kogan Page | Edition 2, 2017 |

**E-Resources:**

https://bbs.binus.ac.id/management/2017/04/electronic-supply-chain-management-e-scm/
https://www.youtube.com/watch?v=JZTKRwHBkoM
https://industrytoday.com/20-manufacturers-top-secret-for-digital-transformation/
https://governance.business/2019/01/16/portfolio-program-and-project-management-what-are-the-difference/
https://www.sumologic.com/glossary/enterprise-application-integration/

**Semester: IV**
**Course Name: Risk Management & Insurance**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM401** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Knowledge of risk management
- Good communication and presentation skill
- Knowledge of insurance Industry

**Module – 1 Introduction to Risk Management and Risk Identification 08 Hours**

| |
|---|
| Risk – Risk and Uncertainty – Types of Risk – Burden of Risk – Sources of Risk- Methods of handling Risk – Degree of Risk- Management of Risk. Risk Identification- Business Risk Exposures – Individual Exposures – Exposures of Physical Assets – Exposure of Financial Assets – Exposures of Human Assets – Exposures to Legal Liability- Exposure to Work-Related Injury. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the types of risks in different industries. |

**Module – 2 Risk Management Techniques 08 Hours**

| |
|---|
| Risk Management – Evaluating the Frequency and Severity of Losses – Risk Control – Risk Financing Techniques – Risk Management Decision Methods – The changing scope of Risk Management – Insurance Market Dynamics – Loss Forecasting – Financial Analysis in Risk Management-Decision Making – Other Risk Management Tools. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the modern risk management tools and techniques |

**Module – 3 Basics of Insurance 08 Hours**

| |
|---|
| Introduction to Insurance Risk and Insurance – Definition and Basic Characteristics of Insurance – Requirements of an Insurable Risk – Adverse Selection and Insurance – Insurance Vs Gambling, Insurance Vs Hedging – Types of Insurance – Essentials of Insurance Contracts. Indian Insurance Industry – Historical Framework of Insurance, Insurance sector Reforms in India. IRDA – Duties and powers of IRDA – IRDA Act 1999. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the structure of insurance organizations |

**Module – 4 Life Insurance** **08 Hours**

| |
|---|
| Life Insurance – Basics of Life Insurance – Growth of Actuarial Science – Features of Life Insurance – Life Insurance Contract – Life Insurance Documents –Life Insurance Classification – Classification on the Basis – Duration – Premium Payment – Participation in Profit – Number of Persons Assured – Payment of Policy Amount – Money Back Policies – Unit Linked Planned Plans – Annuity Vs Life Insurance – Classification of Annuities. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the various types of life insurance policies. |

**Module-5 General Insurance** **08 Hours**

| |
|---|
| General Insurance Contract – General Insurance Corporation (GIC) – Health Insurance – Individual Medical Expense Insurance – Long Term Care Coverage –Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Employee Group Insurance – Features of Group Health Insurance – Fire Insurance – Essentials of Fire Insurance Contracts – Types of Fire Insurance Policies – Marine Insurance – Types of Marine Insurance – Marine Insurance principles-Motor Vehicles Insurance – Need for Motor Insurance – Types of Motor Insurance – Factors to be considered for Premium Fixing |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the various types of general insurance policies. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Analyze the various types of risks and their exposures.
CO2: Apply the tools and techniques of risk management.
CO3: Apply the rules and regulations of IRDA to insurance business.
CO4: Evaluate the different life insurance policies.
CO5: Evaluate the types of general insurance policies.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

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- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Principles of Risk Management and Insurance | George E Rejda | Pearson | 12th Edition, 2009 |
| 2. | Insurance and Risk Management | P.K.Gupta | Himalaya Publishing House | 1st Edition, 2010 |
| 3. | Introduction to Risk Management and Insurance | Dorfman, Mark S | Prentice Hall India | 10th Edition, 2008 |
| **Reference Books** | | | | |
| 1. | Risk Management and Insurance | Scott. E. Harrington<br>Gregory R Niehaus | Tata McGraw Hill Publishing Company Limited | 2nd Edition 2007 |
| 2. | Principles and Practice of Insurance | P. Periasamy | Himalaya Publishing House | 2nd Edition 2009 |
| 3. | Risk Management and Insurance | C. Arthur Williams<br>Jr. Peter Young<br>Michael Smith | Tata McGraw Hill Publishing Company Limited | 8th Edition 2007 |

**Semester: IV**
**Course Name: Financial Derivatives**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM402** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Basic knowledge of finance
- Understanding of international business environment
- Through knowledge in capital markets

**Module – 1 Foundation of Financial Derivatives 08 Hours**

| |
|---|
| Meaning, benefits, types (both exchange traded and OTC traded) and features of financial derivatives-Factors causing growth of derivatives-functions of derivatives market-Derivative market players (Hedgers, speculators and arbitragers)-Derivatives market in India. Commodity Derivative Market: Meaning of commodity derivatives-Commodity derivative exchanges (with commodities traded) in India-Trading and settlement system of commodity derivatives-SEBI Guidelines for commodity market-commodities traded. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Visit the website of FEDAI and understand the regulations for Commodity Exchanges |

**Module – 2 Futures and Forwards 08 Hours**

| |
|---|
| Meaning, features and types of futures/forwards-Futures vs Forwards-Mechanics of buying and selling futures/forwards-Hedging through futures/forwards-Marking-to-market process-contract specifications of stock, index and commodity futures–valuation of futures/forwards using cost of carry model-Arbitrage process-Interest Rate Futures & options. (Numerical problems on MTM and valuation of futures/forwards). |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Study the different types of Future contracts traded on NSE |

**Module – 3 Option Contracts 08 Hours**

| |
|---|
| Meaning, features and types of option contracts-Options vs futures/forwards-Mechanics of buying and selling option contracts-contract specifications of stock, index and commodity options-Option pricing-factors affecting option pricing-Valuation of option contracts using Black Scholes model and Binomial model-Put-call parity theory-Option Greeks-Option Trading strategies |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Study the different types of Options contracts traded on NSE |

**Module – 4 Financial Swaps** **08 Hours**

| |
|---|
| Meaning, features and advantages of financial swaps-Types of financial swaps (Interest rate swap, currency swap, equity swap and commodity swap)-Mechanics of interest rate swaps– Triangular swap (Numerical problems only on interest rate swap including triangular swap)-valuation of interest rate swaps- Only theory. |
| Teaching-Learning Process: |
| Pedagogy: Excel based calculation, research articles<br>Skill Enrichment Exercise: Understand how different types of quotations helpful to the participants in Forex |

**Module – 5 Emerging trends in risk Management** **08 Hours**

| |
|---|
| Exotic Options, Interest rate derivatives, Weather derivatives , Energy derivatives, Insurance derivatives .Credit Derivatives-Total Return Swap (TRS)-Credit Default Swap (CDS)-Types of CDS-Asset Backed Securities (ABS)-Collateralized Debt Obligation (CDO)-Sub-Prime Crisis-2007-Credit Spread Options. Value-at-Risk-Meaning, VaR Models-Historical simulation-Stress testing and back testing –Model building approach , Linear Model Monte Carlo simulation – ( Numerical problems on model building approach only) |
| Teaching-Learning Process: |
| Pedagogy: Case study discussion, articles from Magazine and research related.<br>Skill Enrichment Exercise: Case study on failure of credit derivatives and its implication of Sub Prime Financial Crisis-2007 |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the principles and concepts of financial derivatives in derivative markets.
CO2: Apply the mechanism of forwards, futures, options and financial swaps.
CO3: Evaluate the financial derivatives using valuation models
CO4: Assess the commodity derivatives market in India
CO5: Evaluate various credit derivatives and VaR

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 70 % Numerical and 30 % percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Options, Futures & Other Derivatives | John C. Hull | Pearson Education | 8/e and 2013 |
| 2 | Options & Futures | Vohra & Bagri | TMH | 2/e |
| 3 | Financial Derivatives-Text & Cases | Prakash B Yaragol | Vikas Publishing | 1/e and 2019 |
| **Reference Books** | | | | |
| 1 | Derivatives-Principles and Practice | Sundaram & Das | McGraw Hill | 4th Edition |
| 2 | Derivatives and Risk Management | Rajiv Srivastava | Oxford University | 2010 |
| 3 | Financial Derivatives Modeling | Christian Ekstrand | Springer | |

**Semester: IV**
**Course Name: Indirect Taxation**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM403** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Basic Knowledge of Annual Budget.
- Fundamentals of Macro Economics.
- Awareness of Taxation policies

**Module – 1 Introduction to GST** **08 Hours**

| |
|---|
| Goods and Services Tax Act: Definitions, Need for GST in India, Dual GST Model.<br>Scope of Supply; Types/ Classification of Supplies Composite and Mixed Supplies<br>Levy Of GST: Chargeability of GST on Supplies , aggregate turnover, Numerical Problems on GST Payable |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Apply the GST principles by a survey among local business community about compliance with GST regime. |

**Module – 2 Time and Value of Supply** **08 Hours**

| |
|---|
| Time of Supply, Change in Rate of Tax in respect of Supply of Goods or Services, Place of Supply and Value of Supply.<br>Simple problems on Time of supply and value of supply |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Assess the GSTR 1 & GSTR 3B, E way Bill and How to calculate and avail Input Tax Credit(ITC) using time and place of Supply |

**Module – 3 Registrations & Assessment in GST** **08 Hours**

| |
|---|
| Registration under GST: Persons not liable for Registration, Compulsory Registration in Certain Cases, Procedure for Registration, Deemed Registration.<br>Returns under GST: Furnishing of Returns, First Return, Revision of Returns and Penalty/Late Fee, Numerical Problems on ITC. |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Analyze documents pertaining to Registration under GST and Returns under GST |

**Module – 4 Customs Duty** **08 Hours**

| |
|---|
| Introduction to Custom duty, Definitions of Assessable value, types of duties, rates of custom duty and other duties including cess, Valuation of Imported Goods.<br>Assessment of Customs; determination of value of goods and tax liability of imported goods. Simple numerical problems on customs. (Theory and Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Explore various forms and rules used in Custom duty |

**Module – 5 Baggage & Introduction to FTP** **08 Hours**

| |
|---|
| General Free Allowance. Penalties under Customs, Seizure of Goods, Confiscation of Goods. Baggage principles, limit on clothing, laptops, electronics, liquor and alcohol.<br>Limit applicable to people travel from Bhutan, Myanmar, China and Nepal. Limit applicable to people travel from other countries other than who travel from Bhutan, Myanmar, China and Nepal. Determination of baggage value; simple problems. (Theory & Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lectures, Case Study etc.,<br>Skill Enrichment Exercise: Apply relevant case studies and the provisions of FTP in the recent times. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply theoretical knowledge of GST for determination of GST levy.
CO2: Analyze the Time, Place & Value of supply
CO3: Evaluation of assessment and returns in GST
CO4: Determine the custom duty liability
CO5: Prepare the statement showing the value of baggage

**Assessment Details**

CIE:

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Indirect Taxes Law and practices | V S Datey | Taxman's | Latest Edition |
| 2 | GST & Customs Law (University Edition) | K.M Bansal | Taxman's | Latest Edition |
| 3 | Goods and Services Tax | Dr. B Mariyappa | HPH | Latest |
| **Reference Books** | | | | |
| 1 | Principles of GST & Customs Law | V.S. Datey and Dr. Krishnan Sachdeva | Taxman's | Latest Edition |
| 2 | Goods & Services Tax (GST) in India | B. Viswanathan | UBS Publishers | Latest Edition |
| 3 | Indirect Taxation | Raj K Agrawal & Shivangi Agrawal | Bharat Law House Pvt. Ltd | Latest Edition |

**Semester: IV**
**Course Name: Wealth Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM404** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Knowledge of Financial Planning.
- Good communication and presentation skill
- Knowledge of investment

**Module – 1 Introduction: Financial Planning 08 Hours**

| |
|---|
| Background- Role of Financial Planner- Financial Planning Process - Contract and Documentation- Client Data Collection- Client Data Analysis - Life Cycle - Wealth Cycle- Risk Profiling and Asset Allocation- Systematic Approach to Investing: Systematic Investment Plan (SIP), Systematic Withdrawal Plan (SWP), Systematic Transfer Plan (STP)- Financial Plan-Goal-based Financial Plan, Comprehensive Financial Plan- Financial Blood-Test Report (FBR) - Financial Planning in India |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the financial planning process |

**Module – 2 Wealth Management & the Economy 08 Hours**

| |
|---|
| Wealth management philosophy, process, Financial Planning to Wealth Management, Financial Planning Vs Wealth Management, Economic Cycles and Indicators- Lag Indicators, Co-incident Indicators, Lead Indicators- Interest Rate Views- Currency Exchange Rate- The Deficits: Revenue Deficit and Fiscal Deficit, Current Account Deficit |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the Economic Cycles and Indicators |

**Module-3 Investment & Risk Management: Equity & Debt 08 Hours**

| |
|---|
| Role of Equity- Active and Passive Exposures – Returns from Passive Exposure to S&P CNX Nifty - Sector Exposure and Diversification- Fundamental and Technical Analysis-Fundamental Valuation Approaches- Investment and Speculation-Leveraging<br>Role of Debt - Deposits and Debt Securities- Valuation of Debt Securities-Yields and Interest Rate Risk-Interest Rate and Debt Investments-Credit Exposure and Debt Investments-Concentration Risk-Passive Investments in Debt |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the role of Equity and Debt |

**Module-4 Investment & Risk Management: Alternate Assets 08 Hours**

| |
|---|
| Gold: Role of Gold - Gold Investment Routes- Rupee returns from Gold<br>Real Estate- Role of Real Estate- Real Estate Investment Routes - Real Estate Indices<br>Financial derivatives – meaning- need- benefits and types of derivatives |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the relevance of Gold and Real Estate as a strategic asset |

**Module-5 Risk Profiling & Asset Allocation 08 Hours**

| |
|---|
| Risk Profiling - Why Asset Allocation - Strategic Asset Allocation- Tactical Asset Allocation- Fixed Asset Allocation - Flexible Asset Allocation - Asset Allocation Returns in Equity and Debt: Fixed Asset Allocation with Annual Re-balancing, Flexible Asset Allocation - Asset Allocation Returns in Equity, Debt and Gold: Fixed Asset Allocation with Annual Re-balancing, Flexible Asset Allocation- Allocation to Speculation- Diversification in Perspective |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the risk profiling aspects of investors |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the concepts of financial planning.
CO2: Analyze the process, phases and growth of Indian wealth management market
CO3: Analyze the ability to invest and understand the time of investment in equity & debt.
CO4: Evaluate the types of alternate asset classes.
CO5: Communicate the role of Asset Allocation and wealth management strategies

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1. | Wealth Management | Dun & Bradstreet | Tata McGraw Hills Publications | 2009 |
| 2. | Wealth Management & Financial Planning Concepts & Practices | Balaji Rao D.G. | Partridge Publishing India | 2015 |
| 3. | Wealth Engine: Indian Financial Planning & Wealth Management Handbook | Sundar Sankaran | Vision Books | 2012 |
| **Reference Books** | | | | |
| 1. | Wealth Management in the New Economy: Investor Strategies for Growing, Protecting and Transferring Wealth. | Norbert M. Mindel & Sarah E. Sleight & | Wiley | 1st edition, February, 2010 |

**Semester: IV**
**Course Name: Behavioral Finance**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM405** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamental of economics and finance
- Basics of saving and Investment
- Understanding of Capital market activities

**Module – 1 Foundation of Rational Finance** **08 Hours**

| |
|---|
| Expected utility theory, Modern portfolio theory, Capital asset pricing model (CAPM); efficient markets hypothesis; Agency theory; the influence of psychology. Efficient Markets versus Irrational Markets. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Discuss application of Event study methodology |

**Module – 2 Foundations of Behavioral Finance** **08 Hours**

| |
|---|
| Introduction to Behavioral finance – Nature, scope, objectives and application; Investment Decision Cycle: Judgment under Uncertainty, debates of Standard Finance Versus Behavioral Finance, the three themes of Behavioral Finance. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Discuss articles contributed by Prof Daniel Kehmann Behavioral Theory |

**Module – 3 Behavioral Finance from Micro Level** **08 Hours**

| |
|---|
| Define individual investor's biases, The Irrational Influence: heuristics Driven Biases (Representativeness, Overconfidence, Anchoring, Confirmation, Illusion of Control , Affect heuristic, Regret aversion , Aversion to ambiguity and Innumeracy ), Frame Dependence( Prospect Theory, Mental Accounting , Narrow Framing, Behavioral Portfolio). Strategies for Overcoming Psychological Biases. |
| Teaching-Learning Process: |
| Pedagogy: Case Study<br>Skill Enrichment Exercise: Application of Behavioral bias to real life cases. |

**Module – 4 Behavioral Finance from Macro Level** **08 Hours**

| |
|---|
| Define anomalies, types of Market anomalies: Fundamental Anomalies, Technical Anomalies, and Calendar Anomalies. |
| Teaching-Learning Process: |
| Pedagogy: Excel based calculation, research articles<br>Skill Enrichment Exercise: Discuss Calendar anomaly using Econometrics |

**Module – 5 Advance Behavioral Finance** **08 Hours**

| |
|---|
| Market Bubbles: Identification and causes, investor behavior during bubbles, case study of prominent market bubbles/scams. Introduction to Behavioral Corporate Finance, Introduction to Neuro Finance. |
| Teaching-Learning Process: |
| Pedagogy: Case study discussion, articles from Magazine and research related.<br>Skill Enrichment Exercise: Case study of Financial Crisis-2007 & Global Pandemic- COVID-19 on Stock Markets. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Gain the knowledge of behavioral finance and its importance in investment decisions
CO2: Analyze the investor behavior during the market bubbles
CO3: Comprehend the apply the behavioral models for investment decision making.
CO4: Evaluate the investor behavioral bias and its implication
CO5: Identify the various development of in market behavior.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Behavioral Finance and Wealth Management | Michael M.Pompian | Wiley Publisher | 2/e and 2012 |
| 2 | Investment Analysis and Portfolio Management | Prasanna Chandra | McGraw Hill | 4/e and 2014 |
| | Beyond Greed and Fear | Hersh Shefrin | Publisher Oxford University Press | 2007 |
| **Reference Books** | | | | |
| 1 | The Psychology of Investing | John R. Nofsinger | Pearson Prentice Hall | 4th Edition |
| 2 | The psychology of judgment and decision-making | Plous, S | McGraw-Hill. | |
| 3 | Inefficient Markets: An Introduction to Behavioral Finance | Shleifer, Andrei | Oxford University Press, Oxford. | 2000 |
| 4 | The Scam | Debashis Basu, Sucheta Dalal | Kensource | 4th Edition |

**Semester: IV**
**Course Name: International Financial Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAFM406** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Key personal skills including presentation, argumentation, evaluation, problem solving, self-appraisal, and autonomy
- Theoretical knowledge to personal investments and financial careers
- Knowledge of Business, Accounting, International Studies, Economics

**Module – 1 International Financial Environment — 08 Hours**

| |
|---|
| Importance, rewards & Risk of international finance- Goals of MNC- International Business methods. Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Equilibrium & Disequilibrium, International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU). (Only Theory). |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the BOP of India for the last 5 years |

**Module – 2 Foreign Exchange Market — 08 Hours**

| |
|---|
| Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behaviour-Cross Rates- - Bid – Ask – Spread (Theory & Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Track and analyze the rupee exchange value against Dollar and Euro in spot and forward markets for one week and record the observations |

**Module – 3 International Financial Markets and Instruments — 08 Hours**

| |
|---|
| Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets, International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements. (Only Theory). |
| Teaching-Learning Process: |
| Pedagogy :Lecture, Case Study<br>Skill Enrichment Exercise: Visit the foreign exchange department of a bank, study the operations and submit a report |

**Module – 4 Forecasting Foreign Exchange rate 08 Hours**

| |
|---|
| International Parity Relationships, measuring exchange rate Movements-Exchange rate equilibrium – Factors effecting foreign exchange rate- Forecasting foreign exchange rates. Interest Rate Parity, Purchasing Power Parity &International Fisher effects, Arbitrage, Types of Arbitrage – Locational, Triangular and Covered Interest Arbitrage. (Theory & Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Examine the relationship between inflation level and Purchasing power parity |

**Module – 5 Foreign Exchange exposure 08 Hours**

| |
|---|
| Foreign Exchange exposure: Management of Transaction Exposure-Management of Translation Exposure Management of Economic Exposure-Management of political Exposure- Management of Interest rate exposure. (Theory & Problems). |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study<br>Skill Enrichment Exercise: Study the different types of swaps used in Foreign Exchange Market |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the fundamentals of balance of payment in International Financial Environment

CO2: Analyze the foreign exchange market, participants and transactions.

CO3: Evaluate the International Financial Markets and Instruments

CO4: Forecast the Foreign Exchange rate

CO5: Evaluate the manage the foreign Exchange exposure

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 50 percent theory and 50 percent problems in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | International Corporate Finance | Jeff Madura | Cengage Learning | 10/e 2012 |
| 2 | International Finance Management | Eun & Resnick | Tata McGraw Hill | 4/e, 2014 |
| 3 | Financing International Trade: Banking Theories and Applications | Gargi Sanati | Sage Publication | 1/e, 2017 |
| **Reference Books** | | | | |
| 1 | International Financial Management | Apte P. G | Tata McGraw Hill | 6/e, 2011 |
| 2 | International Financial Management | MadhuVij | Excel Books | 2010 |
| 3 | International Financial Management | Thummuluri Siddaiah | Pearson India | 1/e, 2009 |

**Semester: IV**
**Course Name: SALES MANAGEMENT**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM401** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of Marketing Management.
- Basics of Distribution Chanel Network
- Basics of Trade and Commerce

**Module – 1 Introduction to sales management 08 Hours**

| |
|---|
| Meaning, Evaluation, Importance, Personal Selling, Emerging Trends in Sales Management, elementary study of sales organizations, qualities and responsibilities of sales manager. Types of sales organizations. Sales as a career, Changing role of sales force, Revolution in Technology, Customer Relationship Management (CRM), Sales force Diversity, Team Selling Approach, Managing Multi-channels. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Interview a salesperson and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why chose sales career, and what does it take to succeed in this profession. |

**Module – 2 Selling Skills & Selling Strategies&Management of Sales Territory & Sales Quota 06 Hours**

| |
|---|
| Selling and buying Styles, selling skills, situations, selling process, sales presentation, Handling customer objections, Follow-u action.<br>Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting quota |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc. from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones. |

**Module – 3 Sales Force Recruitment, Selection and Motivation 10 Hours**

| |
|---|
| Recruitment and selection of sales force, Training of sales force. Sales force motivation and compensation, Nature of motivation, Importance, Process and factors in the motivation. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Students are asked to prepare presentation on any product or the services of student choice, covering selling strategies and sales process. |

**Module – 4 Sales force Compensation** **08 Hours**

| |
|---|
| Compensation-Meaning, Types of compensation plans and evaluation of sales force by performance and appraisal process. Sales management job: Standard sales management process-international sales management -international market selection market survey approach or strategy. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>As a sales manager of a company. You make an analysis of what you feel should be roles of a sales manager and a salesperson for maximizing sales of the organization. |

**Module – 5 Sales Managers and Sales Person & Selling on the internet** **08 Hours**

| |
|---|
| Role of sales manager and sales people; functions of sales manager, functions of sales person, types and characteristics of sales manager and sales people-Time management for sales manager and sales person Selling agents for internet trading-net selling, advertising in net trading, payment system in internet trading-smart card, credit card, debit card- payment by card: advantages and disadvantages; How to make internet selling safe-Digital signature, biometric method and legal or regulatory environment; Growth of internet trading in India. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise:<br>Students are to identify current issues in internet trading is: how to make internet selling safe. Different methods have been suggested for safety or security of internet trading. You have to analyze different methods and recommend a method for your company. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO-1: To apply the fundamental principles of sales management, used in appropriate selling situations in selling process

CO-2: To analyze the various selling skills and techniques to develop effective sales administration through sales territories.

CO-3: To evaluate the use of various plan of compensation and control techniques.

CO-4: To communicate various motivation concepts for effective implementation of sales management plans.

CO-5: To design and monitor the effective sales Process with use of human and IT trails.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Sales Management | Charles, Futrell | Thomson South Western | 6/e, 2003. |
| 2 | Sales & Distribution Management | Tapan K. Panda & Sunil Sahadev | Oxford University Press. | 6/e |
| 3 | Managing of Sales Force | Spiro Stanton Rich | TMH | 11/e, 2003 |
| **Reference Books** | | | | |
| 1 | Sales & Retail Management, an Indian perspective | Dr. S.L Gupta | Excel Books | 1/e, 2007. |
| 2 | Salesmanship and Sales Management | P.K Sahu & K C Raut | Vikas Publishing House | 3/e, |
| 3 | Sales Management- | Douglas J Dalrymple, William L Crowe | John Wiley & Co | Latest edition |

**Semester: IV**
**Course Name: Integrated Marketing Communication& Advertising**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM402** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Basic fundamentals of Marketing.
- Knowledge about the fundamentals of promotions.
- Thoughtful knowledge about marketing strategies & plans.
- Creative thinking & Configuration of skills.

**Module 1 – Role of IMC in Marketing Process** **08 Hours**

| |
|---|
| Role of IMC in marketing process, IMC planning model, Marketing and promotion process model. Communication process, steps involved in developing IMC programme, Effectiveness of marketing communications Purpose, Role, Functions, Types, Advertising V/s Marketing mix, Advertising appeal in various stages of PLC. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Choose a product of your choice and design the marketing mix. |

**Module 2 – Advertising Agency and Communication Process** **08 Hours**

| |
|---|
| Type of agencies, Services offered by various agencies, Criteria for selecting the agencies and evaluation. Advertising copy, Advertising objectives and Budgeting: Goal setting – DAGMAR approach, various budgeting methods used, AIDA model. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Student should study the ad agencies and services provided by them in detail. |

**Module 3 – Media Planning** **08 Hours**

| |
|---|
| Developing Media plan, Problems encountered, Media Evaluation Print, Broadcast media, Support media in advertising. Media strategy: Creativity, Elements of creative strategies and its implementation, Importance of Headline and body copy. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Design a media planning for any product/service. |

**Module 4 – Advertisement Monitoring, Evaluation and Control** **08 Hours**

| |
|---|
| Measurement in advertising, various methods used for evaluation, Pre-testing, Post testing.<br>International Advertising: Global environment in advertising, Decision areas in international advertising.<br>Internet advertising: Meaning, Components, Advantages and Limitations, Types of Internet advertising. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Visit an industry and analyze the overall operations. |

**Module 5 - Traditional & Digital Media in Advertising** **08 Hours**

| |
|---|
| Features, Functions, Growth, Advantages/ Disadvantages, And Direct Marketing Strategies. Promotion: Meaning, Importance, tools used, Conventional/unconventional, drawbacks, push pull strategies, Co-operative advertising, Integration with advertising and publicity Public relation/ Publicity:- Meaning, Objectives, tools of public relations, Public relation strategies, Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR V/s Publicity. E- Commerce and Digital Media, Advertising on Digital Media, Social Media, Mobile Adverting, E-PR. Retailer Promotions-Consumer Promotions (Coupons, Rebates, and Loyalty Programs, Online, and Special Event Promotions) |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Case study on advertising and promotional strategies in business marketing. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply comprehensive IMC framework models and principles of advertising programme.
CO2: Evaluate the components of IMC for strategic advantage and effective advertising.
CO3: Analyze various components of IMC and make appropriate media planning.
CO4: Create and measure effective advertisement with strategic intent.
CO5: Design the advertising program by considering the global scenario using technology.

**Assessment Details**

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

## Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Advertising and Promotions IMC Perspectives | Belch and Belch | Tata McGraw Hill | 9/e, 2012. |
| 2 | Advertising & Integrated Brand Promotion | O'Guinn, Allen, Semenik | Cenage Learning | New edition |
| **Reference Books** | | | | |
| 1 | Integrated Advertising, Promotion, and Marketing Communications | Clow, Baack | Pearson Education, 2007. | 3/e |
| 2 | Advertising an IMC perspective | S.N.Murthy& U Bhojanna | Excel Books | Latest edition |
| 3 | Sales Promotion: Concepts, Methods, and Strategies | Robert C. Blattberg& Scott A. Neslin | Prentice- Hall | Latest edition |

**Semester: IV**
**Course Name: Digital and Social Media Marketing**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM403** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of Digital and Social Media Marketing
- Basics of Marketing e-retailing
- Basics of E-Commerce

**Module – 1: Introduction to digital marketing** **08 Hours**

| |
|---|
| The Digital Marketing Framework, Need for Digital Marketing, Difference between Traditional Marketing and digital Marketing, what is digital marketing strategy, Digital Marketing Manager-Role and functions, ROI between Digital and traditional marketing, understanding the current business, Basics of Internet, Types of Digital Marketing: E-mail Marketing, Social Media Marketing, Mobile Marketing, Influencer Marketing, Viral Marketing, Search Engine Marketing.<br>E-Marketing Plan: Overview of the E-Marketing Planning Process – Creating an E Marketing Plan– A Seven-Step E-Marketing Plan. The E-Marketing Environment: Overview of Global E-Marketing Issues – Country and Market Opportunity Analysis – Technological Readiness Influences Marketing – The Digital Divide Ethical and Legal Issues – Privacy – Digital Property–Cyber Crime-- Cyber Security. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss of Privacy issue of digital marketing. |

**Module – 2: E-Marketing Research** **08 Hours**

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|---|
| Definition and meaning of research. Data Drive Strategy – Marketing Knowledge Management – Monitoring Social Media – Technology-Enabled Approaches – Real-Space Approaches –Marketing Databases and Data Warehouses – Data Analysis and Distribution – Knowledge Management<br>Metrics - Consumer Behaviour Online – Segmentation – Targeting –Differentiation – Positioning Strategies. Data Analytics: Introduction, Key terms and concepts. Working with data. Setting objectives, goals and KPIs. Tracking and collecting data. Analyzing data. Advantages and challenges. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss on Process of e-Marketing Research |

**Module – 3: Marketing Management** **08 Hours**

| |
|---|
| Product – Products on Internet – Creating Customer Value Online– Product Benefits – E-Marketing Enhanced Product Development – Price – Change in Pricing Strategies – Buyer and Seller Perspectives – Payment Options – Pricing Strategies – Distribution– Online Channel Intermediaries – Distribution Channel Length and Functions – Channel Management and Power – Distribution Channel Metrics.<br>Search Engine Optimization and Content Development: Realistic Goal Setting, Keyword Search, Google Web master guidelines, Crawling and indexing, Page ranking, Google search console<br>Social Media: Facebook Pages, Facebook Business Suite, Instagram Page, LinkedIn Page, Twitter profile for your business, kooapp, WhatsApp Business |

| |
|---|
| Content Development: Choosing appropriate Images for the website, Important aspects to keep in mind for Content writing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to study on influence of social media |

**Module – 4: Customer Acquisition and Retention** **08 Hours**

| |
|---|
| Profile of Consumers – Browsing Behaviour Model – Elements of Social Media – Social Media Strategies – Social Media Performance Metrics – Building Customer Relationships – Relationship Marketing – Stakeholders – Three Pillars of Relationship Marketing – Customer Relationship Management (CRM) – CRM Building Blocks – Ten rules for CRM Success. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Case study on e-CRM |

**Module – 5: Social Media Channels** **08 Hours**

| |
|---|
| Introduction, Key terms and concepts, Traditional media Vs Social media. Social media channels: Social networking. Content creation, Bookmarking & aggregating and Location & social media. Tracking social media campaigns. Social media marketing: Rules of engagement. Advantages and challenges. Dealing with opportunities and threats. Step-by-step guide for recovering from an online brand attack. Social media risks and challenges.<br>Display Advertising: meaning, Process, Goals, Search Advertising V/s display advertising, types of display advertising, Organising display advertising and Google Ads.<br>Video advertising and marketing: strategic fit of video marketing, video content and budgeting, promoting videos, sharing videos, advertising on video sharing sites, Video marketing metrics. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss on different Social media channels. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Recognize appropriate digital marketing objectives.
CO2: Identify the role and implications of different Marketing Research.
CO3: Identifying about the SEO and online advertising.
CO4: Comprehend the role of E-CRM.
CO5: Analyze the role of Social media and its channels.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Digital Marketing: Strategy, Implementation and Practice | Chaffey D & Ellis-Chadwick | Pearson publishers | 5th Edition, 2012 |
| 2 | E-Marketing | Judy Strauss and Raymond Frost | Prentice Hall | 6th Edition, 2013 |
| 3 | Internet Marketing: Integrating Online and Offline Strategies | M. L. Roberts and Debra Zahay | Cengage Publishing | 3rd edition, 2013 |
| **Reference Books** | | | | |
| 1 | E-Commerce: An Indian Perspective | P. T. Joseph | Prentice Hall, | 4th edition |
| 2 | Up and out of poverty: the social marketing solution | Kotler, P. and Lee, N. | Pearson Education. | |
| 3 | How Social marketing works in Healthcare’ | Evans | BMJ, BMJ Publishing Group Ltd. | 2006, Edition |

**Semester: IV**
**Course Name: Strategic Brand Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM404** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basic concepts of marketing.
- Understanding of branding concepts.
- Understanding of national & global brands of different marketeers.
- Knowledge of how branding can play a competitive advantage.

**Module 1 - Introduction to the Concept of Brand Management — 08 Hours**

| |
|---|
| Brand –Meaning, Definition, Evolution of Brands, Functions of Brand to consumer, Role of Brand- Advantages of Brand, Product V/s Brand, Branding- Meaning, Creation of Brands through goods, services, people, Organization, Retail stores, places, online, entertainment, ideas, challenges to Brand builders Brand Management-Meaning & Definition. Strategic Brand Management Process-Meaning, Steps in Brand Management Process Strong Indian Brands. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Choose various national and multinational brands and analyze its strategies. |

**Module 2 - Customer Based Brand Equity — 08 Hours**

| |
|---|
| Customer Based Brand Equity-Meaning, Model of CBBE Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks Resonance, Judgments, Feelings, performance, imagery, salience-Brand Building Implications, Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism, Brand positioning – Meaning, Point of parity & Point of difference, positioning guidelines Brand Value: Definition, Core Brand values, Brand mantras, Internal branding. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Choose a failure brand analyze it and frame repositioning strategies. |

**Module 3 - Choosing Brand Elements to Build Brand Equity — 08 Hours**

| |
|---|
| Criteria for choosing brand elements, options & tactics for brand elements-Brand name, Naming guidelines, Naming procedure, Awareness, Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging. Leveraging Brand Knowledge: Meaning of Brand Knowledge, Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Case study on branding elements to create brand equity. |

**Module 4 - Designing and Sustaining Branding Strategies 08 Hours**

| |
|---|
| Brand hierarchy, Branding strategy, Brand extension and brand transfer, Managing Brands overtime. Brand Architecture and brand consolidation. Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation V/s Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies, Brand extension. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Choose a multinational company product and analyze the brand portfolio and brand extension for the same. |

**Module 5 – Luxury Brand Management & Making Global Branding 08 Hours**

| |
|---|
| Geographic extension, sources of opportunities for global brand, single name to global brand, consumers & globalization, conditions favoring marketing, barriers to globalization, managerial blockages, organization for a global brand, pathways to globalization.<br>Luxury Brand Management: basic psychological phenomena associated with luxury purchase, luxury marketing mix. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Students can choose 2 popular brands, identify & examine the criteria for success in luxury brand industry. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the fundamental concepts of strategic brand management in the global scenario.
CO2: Analyze the role of brands, the concept of brand equity, and the advantages of creating strong brands.
CO3: Evaluate the elements of products, services and brand management and equity.
CO4: To develop familiarity and competence with strategies involved in building, leveraging and defending strong brands.
CO5: Design the strategies to enter into the global market with global brand and sustain.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
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**Final CIE Marks = (A) + (B)**

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- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Strategic Brand Management, Building Measuring & Managing Brand Equity | Kevin Lane Keller | Pearson Education | 2nd Ed Phi |
| 2 | Brand Management -The Indian Context | Y L R Moorthi | Vikas Publication | New edition |
| **Reference Books** | | | | |
| 1 | Strategic Brand Management | Jean, Noel, Kapferer | Kogan Page India | Latest edition |
| 2 | Strategic Brand Management | Richard Elliott & Larry Perclu | Oxford Press | 1/e |
| 3 | Strategic Brand Management | Jean, Noel, Kapferer | Kogan Page India | Latest edition |

**Semester: IV**
**Course Name: Rural Marketing**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM405** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Awareness of rural markets.
- Understanding of rural and urban market consumer's psychology.
- Exposure to the rural markets products/services.
- Logical and reasoning ability to deal with rural consumers.

**Module 1 - Introduction to Indian Rural Marketing 08 Hours**

| |
|---|
| Definition, scope of rural marketing, concepts, classification of rural markets, rural vs. urban markets. Rural marketing environment: Population, occupation pattern, income generation, location of rural population, expenditure pattern, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities, rural credit institutions, rural retail outlets, print media in rural areas, rural areas requirement, rural demand and rural market index, problems in rural marketing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: List down all various government schemes and programs initiated for rural consumers. |

**Module 2 - Rural Consumer Behaviour 08 Hours**

| |
|---|
| Consumer buying behaviour models, Factors affecting Consumer Behaviour, Social factors, Technological Factors, Economic Factors, Political Factors, Characteristics of Rural consumer- Age and Stages of the Life cycle, Occupation and Income, Economic circumstances, Lifestyle, Personality and Brand Belief, Information Search and pre-purchase Evaluation, Rise of Consumerism, Consumer Buying Process, Opinion Leadership Process, Diffusion of Innovation, Brand Loyalty, Rural Vs Urban Marketing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Visit to a nearby village and understand the market structure and functioning of rural markets. |

**Module 3 - Rural Marketing Strategies & Marketing of Agricultural Inputs 08 Hours**

| |
|---|
| Selection of Markets - Product Strategy - Product mix Decisions – Competitive product strategies for rural markets.<br>Marketing of agricultural inputs: Indian tractor industry: Challenges for Indian tractor industry, factors suggesting better future prospects for tractor industry, marketing strategies for tractor industry. Fertilizer industry in India: Classification of fertilizer industry, Challenges for marketing of fertilizer industry, marketing strategies for fertilizer industry. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Rural India: A Promising Market Place-A Case Study |

**Module 4 - The Rural Pricing Strategies & Agricultural Product Marketing 08 Hours**

| |
|---|
| Pricing strategy - pricing policies - innovative pricing methods for rural markets - promotion strategy - appropriate media - Designing right promotion mix – promotional campaigns.<br>Marketing Agricultural Products: Marketing of rural artisan products, Characteristics of Indian handicrafts industry, marketing strategies for the development of rural artisan sector.<br>Rural marketing of financial services: Challenges in marketing for banking services in rural, opportunities for banking in rural areas, marketing strategies for banking services. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Student should launch a new product designing the rural marketing mix. |

**Module 5 - Rural Distribution & Communication Strategy & Recent Trends 08 Hours**

| |
|---|
| Distribution - Logistics Management - Problems encountered - selection of appropriate channels. Rural media- Mass media, Non-Conventional Media, Personalized media.<br>Recent Trends in rural marketing:<br>E-Commerce: Importance of E-Commerce and Impact of E-Marketing on rural consumers, Concept of Digital Village, Role of Social Media in rural marketing.<br>Information Technology: Impact of IT in Agricultural Marketing, E-Chaupal applications, Project Shakti, Web-casting-online training and guidance to farmers.<br>Online Marketers: Role of Online Marketers, Growth and Challenges |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercises: Developing a Rural Market e-hub-The case study of e-Choupal |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the fundamental rural marketing concepts in the real world scenario.
CO2: Analyze the various characteristics of Indian rural markets consumers in comparison with urban economy.
CO3: Evaluate the roadblocks of Indian rural market and advocate solutions for the problems of rural markets.
CO4: Design the marketing agricultural inputs to be adopted by Indian companies for rural development.
CO5: Communicate the various distribution and communication strategies to be implemented for the success of any rural products/services brand.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
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- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Rural Marketing | Pradeep Kashyap & Siddhartha Raut | Biztantra | Latest Edition |
| 2 | Rural Marketing | GopalSwamy T.P | Vikas Publishing House | 3/e |
| Reference Books | | | | |
| 1 | Rural Marketing | Mathur U. C | Excel Books | I/e |
| 2 | Rural Marketing | Krishnamacharyulu C. G & Lalitha Ramakrishnan | Pearson Education | Latest Edition |
| 3 | Agricultural Marketing In India | Acharya | Oxford I B H | Latest Edition |

**Semester: IV**
**Course Name: International Marketing Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAMM406** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Fundamentals of International Marketing Management
- Basics of Marketing
- Basics of E-Commerce

**Module – 1: Introduction to Global Marketing** **08 Hours**

| |
|---|
| The different meanings of 'global marketing' (globalization and glocalization) The meaning of the value chain in international marketing. The Importance of Global Marketing, Forces Affecting Global Integration and Global Marketing the Scope and Challenge of International Marketing.<br>Motives for firms going international; Three theories explaining firms' internationalization process. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss on International Marketing Management and its challenges. |

**Module – 2: Product Decisions in Global Marketing** **08 Hours**

| |
|---|
| Global Market segmentation, Assessing Market potential and choosing Target Markets, Targeting and Target Market strategy options, Positioning. Product decisions Standardization or adaptation of products, International service strategies, PLC and IPLC Product communication alternatives, Branding decisions (sensory branding) Environmental strategies 'Long tail' strategies |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to study on IPLC |

**Module – 3: Pricing Decisions in Global Market** **08 Hours**

| |
|---|
| Global Pricing Objectives and Strategies; Factors influencing international pricing, Price escalation, Currency markets and pricing, dumping and antidumping, countertrade, Crude oil price determination, International logistics price determination, Tariffs, crypto currencies, International insurance management. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to visit a Manufacturing organization where products are exported. |

**Module – 4: Global Distribution Decision** **08 Hours**

| |
|---|
| Structure of the channel (intensive, selective and exclusive) Managing and controlling distribution channels Managing Logistics Most common export documents Transportation Internationalization of retailing Grey market.<br>Global Marketing Communications Decisions: Global Advertising, Advertising Agencies: Organizations and Brands, Creating Global Advertising, Global Media Decisions, Public Relations and Publicity. Sales Promotion, Personal Selling, and Special Forms of Marketing. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Visit organization and meet marketing head and discuss about required sales skills. |

**Module – 5: Export Documentations** **08 Hours**

| |
|---|
| ProForma Invoice, Customs Packing List. Country of Origin or COO Certificate. Commercial Invoice. Bill of exchange, Export License, Warehouse Receipt, Health Certificates, Bill of Entry, Import License, Insurance certificate, RCMC Registration cum Membership Certificate, GATT/DGFT declaration, Technical write up, literature, Industrial License, Dangerous Goods certifications. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, Case Study, Video clippings, Group Discussion, Experiential Learning.<br>Skill Enrichment Exercise: Students are asked to discuss on Logistics Management and Procurement. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Recognize the environment of international marketing management its process, theories and challenges.
CO2: Identify the role of product decisions in international marketing.
CO3: Identification of pricing decisions in global marketing.
CO4: Comprehend the role of global distribution and global marketing communication decisions
CO5: Analyze about logistics and procurement Management.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | International marketing | Rakesh Mohan Joshi | Oxford | 2004 |
| 2 | International marketing | Michael Czinkota, Illka A. Ronkainen, | cenage Learning | 2004 |
| 3 | International Marketing | Caterora. P, Gilly .M & Graham. J | Tata McGraw-Hill Publications | 2011, 15thEdition |
| 4 | International marketing: analysis and strategy | Sak Onkvisit, John shaw | Biztantra | 4/e |
| **Reference Books** | | | | |
| 1 | Global Marketing | Hollensen, Svend | Pearson Education | 7thEdition, 2017 |
| 2 | Global Marketing Management | Warren J. Keegan & Mark C. Green | Pearson Education | 9thEdition, 2018 |
| 3 | International Marketing | Catero, Graham. | 15/e, TMH | 2012 |

**Semester: IV**
**Course Name: Leadership & Building Organization**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR401** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Good communication & Presentation skills.
- Basic Knowledge of Leadership, Teams.
- Awareness of Self-Awareness, Self-Discipline, Leadership Development Program.
- Basic Concepts of Culture.

**Module – 1 Introduction** **04 Hours**

| |
|---|
| Concept of Leadership, Ways of Conceptualizing Leadership, Definition and Components, Leadership Described, Trait Versus Process Leadership, Assigned Versus Emergent Leadership. Leadership and Power, Leadership and Coercion, Leadership and Management. Indian Business Leaders. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: List out the traits of a successful leader from the top corporates |

**Module – 2 Leadership Approaches** **08 Hours**

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|---|
| Trait Approach: Intelligence, Self-Confidence, Determination, Integrity, Sociability, Five-Factor Personality Model and Leadership, Emotional Intelligence.<br>Skills Approach: Three-Skill Approach, Technical Skill, Human Skill, Conceptual Skill, Skills Model, Competencies, Individual Attributes, Leadership, Outcomes, Career Experiences, Environmental Influences.<br>Behavioral Approach: The Ohio State Studies, The University of Michigan Studies, Blake and Mouton's Managerial (Leadership) Grid, Authority–Compliance (9, 1), Country-Club Management (1, 9) Impoverished Management (1, 1), Middle-of-the-Road Management (5, 5), Team Management (9, 9), Paternalism/Maternalism, Opportunism.<br>Situational Approach: Description, Leadership Styles, Development Levels. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Meet any Leader- Organization or Academic and ask 10 questions related to Leadership. Then analyze the type of leadership style adopted. |

**Module – 3 Leadership Theories** **10 Hours**

| |
|---|
| Path–Goal Theory: Leader Behaviors, Directive Leadership, Supportive Leadership, Participative Leadership, Achievement-Oriented Leadership, Follower Characteristics, Merits and Demerits<br>LMX Theory: Early Studies, Later Studies, Leadership Making, Merits and Demerits.<br>Transformational Leadership: Definition, Transformational Leadership and Charisma, A Model of Transformational Leadership, Transformational Leadership Factors, Transactional Leadership Factors, Non-leadership Factor, Other Transformational Perspectives Bennis and Nanus, Kouzes and Posner. Merits and Demerits.<br>Authentic Leadership: Definition, Approaches to Authentic Leadership, Practical Approach, Theoretical |

| |
|---|
| Approach, Merits and Demerits.<br>Psychodynamic Approach: The Clinical Paradigm, History of the Psychodynamic Approach, Key Concepts and Dynamics Within the Psychodynamic Approach, Focus on the Inner Theatre,<br>Focus on the Leader-Follower Relationships- Social Defense Mechanisms, Mirroring and Idealizing, Identification with the Aggressor. Focus on the Shadow Side of Leadership Narcissism. Merits and Demerits of Psychodynamic Approach. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Meet 4-5 Leaders from different roles and compare - contrast the different styles on leadership. |

**Module – 4 Leadership Instrument 09 Hours**

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| Culture Definition, Related Concepts, Ethnocentrism, Prejudice, Dimensions of Culture, Uncertainty Avoidance, Power Distance, Institutional Collectivism, In-Group, Collectivism, Gender Egalitarianism, Assertiveness, Future Orientation, Performance Orientation, Humane Orientation, Leadership Behavior and Culture, Clusters, Eastern Europe Leadership Profile, Latin America Leadership Profile, Latin Europe Leadership Profile, Confucian Asia Leadership Profile, Nordic Europe Leadership Profile, Anglo Leadership Profile, Sub-Saharan Africa Leadership Profile, Southern Asia Leadership Profile, Germanic Europe Leadership Profile, Middle East Leadership Profile, Universally Desirable and Undesirable Leadership Attributes. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Analyze a leadership profile of an international leader |

**Module – 5 Ethical Leadership 09 Hours**

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|---|
| Ethics Definition. 3 Levels- Pre-conventional Morality; Conventional Morality; Post conventional Morality; Ethical Theories, Centrality of Ethics to Leadership, Heifetz's Perspective on Ethical Leadership; Burns's Perspective on Ethical Leadership, The Dark Side of Leadership, Principles of Ethical Leadership, Ethical Leaders Respect Others, Ethical Leaders Serve Others, Ethical Leaders Are Just, Ethical Leaders Are Honest, Ethical Leaders Build Community. Case Studies on Ethical Leadership.<br>Leadership Code: Five Rules to lead - Shape the Future, Make Things Happen, Engage Today's Talent, Build the Next Generation and Invest in Yourself.<br>Leadership and Crisis Management. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Draft a list of expected ethical practices of an organization. |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the fundamental concepts of leadership in an organization.
CO2: Apply the knowledge of leadership theories and traits in real world situations.
CO3: Analyze the impact of organizational leadership styles, theories and traits on the followers.
CO4: Evaluate the relationship between culture and leadership profile.
CO5: Design ethical leadership practices in an organization.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

Suggested Learning Resources:

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Leadership: Theory and Practices Leadership for Organisations | Peter G. Northouse | Sage Publication | 7/e, 2016 |
| 2 | Management: Leading People and Organisations in the 21st Century | Gary Dessler | Prentice Hall | 2001 |
| 3 | Charismatic Leadership in Organisations | Jay A. Conger, Rabindra N. Kanungo | Sage Publications | 1998 |
| **Reference Books** | | | | |
| 1 | Leadership: Theory and Practice | Peter G. Northouse | Sage | 2010 |
| 2 | Management: Leading People and Organisations in the 21st Century | Gary Dessler | Prentice Hall | 2001 |
| 3 | The Leadership Code: Five Rules to Lead | Dave Ulrich, Norm Smallwood, Kate Sweetman | Harvard Business Pres | 2008 |
| 4 | Leadership for Organisations | David A. Waldman, Charles O'Reilly | Sage Publications | 2019 |

**Semester: IV**
**Course Name: Personal Growth and Interpersonal Effectiveness**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR402** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basic knowledge about personality traits
- Familiarize with personality testing tools
- Knowledge about individual behaviors

**Module – 1 Introduction to Personal Growth 08 Hours**

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| Meaning, nature and scope of personal growth. Self-awareness and self-esteem, life roles, social roles and organizational roles, role clarity and role boundaries. Ego states- Id, ego and super ego and defense mechanism. Developing a self-improvement plan. Interpersonal Trust: Openness, confidentiality, blind spot and unknown part of personality. Self-disclosure, seeking feedback, self-reflection and practicing new behaviors. Discovering facets of interpersonal trust through Johari Window. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Take the test of Johari window and self assess on the behaviors |

**Module – 2 Understanding Human Personality and Neuro Functioning 08 Hours**

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|---|
| Personality theories, Carl Jung's theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories- Guilford Peogut, PF 16 and Type A and B, Emotional intelligence. Basic functions of mind: Creativity and innovation. Blocks to creativity. Creativity processes and tools-convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Self-assessment on the individual Personality through MBTI test and make necessary changes |

**Module – 3 Self-Management and its Effectiveness 08 Hours**

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|---|
| Personal change meaning, nature and requisites. Understanding Self-Management, Social adjustments and habit formation. Locus of control. Habits of personal effectiveness. Seven habits of highly effective people. Recent trends of self-management. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Study on the different attitudes of individual and the consequences of it. |

**Module – 4 Interpersonal Relations and Personal Growth** **08 Hours**

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|---|
| Interpersonal relations and personal growth: Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, time management and honoring the commitments |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Understand the importance of interpersonal relations in workplace from employees |

**Module – 5 Transactional Analysis** **08 Hours**

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|---|
| Ego states, types of transactions and time structuring. Life position, scripts and games; T-group sensitivity training, encounter groups, appreciative enquiry and group relations conference (students may go through three days personal growth lab for experiential learning) |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Experimental learning of individual through T-group sensitivity test |

**Course Outcomes:**

CO1: Apply the various personality traits which promote personal growth of individual.
CO2: Analyze the concepts of human personality, behaviour and functioning of mind
CO3: Learn and apply the psychometrics tests in understanding the personality traits.
CO4: Develop the greater insight of self, and others through various theories and prepare the developmental plan for interpersonal effectiveness.
CO5: Demonstrate individual's ego state through T-group sensitivity training analysis.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Organizational Behaviour: Human Behaviour at work | John W. Newstrom and Keith Davis | Tata McGraw Hill | 11/e, 2003 |
| 2 | Human Relations in organizations | Robert N. Lussier | McGraw Hill Education | 6/e |
| 3 | Development of Management Skills | Whetten & Cameron | PHI | 7/e |
| 4 | Competency Mapping Assessment and Growth | Naik G. P | IIHRM | 2010 |
| **Reference Books** | | | | |
| 1 | Understanding OB | Udai Pareek | Oxford University Press | |
| 2 | Theories of Personality | Calvin S Hall | Wiley India Pvt. Ltd | 4/e |
| 3 | Seven habits of highly effective people | Stephen R Covey | Pocket Books. | |
| 4 | Training in interpersonal Skills | Stephen Robbins | Pearson Education | |

**Semester: IV**
**Course Name: International Human Resource Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR403** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Knowledge on basic HR concepts
- Familiarize with International HR issues
- Knowledge on importance of Global HRM

**Module – 1 Introduction to IHRM 08 Hours**

| |
|---|
| Meaning and Definition IHRM: Evolution, Challenges, Objectives, IHRM Versus Single Nation-centric HRM<br>IHRM: Approaches, Emergence of Global HR Manager, IHRM; Culture and Cross-Cultural Management, Positivist views: ‘Culture and values’ Interpretive views: ‘Culture and meanings’ Critical views: ‘Culture and power”; Globalization and HRM, Approaches to International Human Resource Management, differentiating between PCNs, TCNs and HCNs |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on affects of Globalization on Work environments |

**Module – 2 Managing Knowledge in Multinational Firms 08 Hours**

| |
|---|
| Introduction, Different types of knowledge, Factors influencing knowledge sharing How to stimulate knowledge sharing Gaining access to external knowledge, Knowledge retention From the management of knowledge to innovation<br>Training and Development: Domestic Versus International Organizations International Training Management: Basic Concepts and Models Leadership Training and Development in International Organizations, Technology in International Training Management. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on importance of Tacit Knowledge and its generation |

**Module – 3 Global Performance Management & Rewards 08 Hours**

| |
|---|
| Introduction, Key components of PMSs, Factors affecting PMSs, Culture and PMSs, Total Rewards in the International Context<br>The current state of total rewards, Complexities faced by IHR managers, International total rewards objectives for the MNC, and Key components of global total rewards programs. Approaches to international compensation, Repatriation issues, and International trends in global total rewards. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Analyzing different components of PMS in MNCs |

**Module – 4 International Assignments and Employment Practices 08 Hours**

| |
|---|
| Introduction, staffing policies, Motives for international transfers, Newer forms of international assignments, Alternative forms of international assignments. The international assignment process, Dimensions of international assignment success, Human Resource Management in Cross-Border Mergers and Acquisitions. Cultural differences and cross-border M&A performance, Managing cross-border integration: the HRM implications. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on affects of M&A on Human Resource |

**Module – 5 Diversity Management 08 Hours**

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|---|
| Equal opportunities, Diversity Management, International Culture Management: Model Organizational Culture and Innovation, Models of Culture, Hofstede's Four Cultural Dimensions, Trompenaar's Seven Cultural Dimensions, Globe's Nine Cultural Dimensions, Edgar Schein's Model of Culture, Deal and Kennedy's Culture Model, Schneider's Culture Model; Profile of Organizational Culture in International Organizations Managing International Culture. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Analyzing affects of culture on the performance of Human capital |

**Course Outcomes:**

CO1: Apply conceptual knowledge and practical experience in understanding the HR concepts globally.
CO2: Analyze and comprehend the strategic approaches of HR aspects amongst PCN's, TCN's and HCN's.
CO3: Evaluate the knowledge of IHRM and apply the concepts in global perspective
CO4: To have a better insight of HR policies and practices by critically analyzing the impact of contemporary issues globally.
CO5: Elaborate the understanding on influence of culture on Global Work environments.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | International Human Resource Management | Srinivas R. Kandula | Sage Publication India Pvt. Ltd. | 2018 |
| 2 | International Human Resource Management | Anne-Wil Harzing, Ashly H. Pinnington | Sage Publication India Pvt. Ltd. | 4/e, 2015 |
| 3 | Diversity at Work | Arthur P Brief | Cambridge University Press | 2008 |
| **Reference Books** | | | | |
| 1 | Strategic Human Resource Management: An International Perspective | Gary Rees, Paul E. Smith | Sage Publication India Pvt. Ltd. | 2014 |
| 2 | Global Talent Management: An Integrated Approach | Sonal Minocha and Dean Hristov | Sage Publication India Pvt. Ltd. | 2019 |
| 3 | International Human Resource Management | Anne-Wil Harzing, Ashly Pinnington | Sage Publication India Pvt. Ltd. | 2011 |

**Semester: IV**
**Course Name: Public Relations**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR404** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Basic knowledge of public relations
- Basic Insights into relationship building and convincing skills
- Good communication & presentation skills
- Logical and observation skills
- Understanding internal and external environments of organization

**Module – 1 Introduction to Public Relations 08 Hours**

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|---|
| Meaning, Definition, Importance of Public Relations, Conceptual and Operational perspectives of PR, Specific functions of PR, Proactive & Reactive approaches; Public Relation Officer roles – Models of Public Relations; Public Relations process. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Analyze the role of PR department in different industries |

**Module – 2 Theoretical Understanding of Public Relations 08 Hours**

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|---|
| UNDERSTANDING THEORITICAL UNDERPINNINGS IN PR : Behavioral Public Relations Model – Persuasion Model – Two way symmetrical Communications Model; Theories of persuasion and social Influence; Theories of Mass communications and its applicability in PR |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Practical orientation of theoretical aspects of different models in handling PR issues |

**Module – 3 Employee Relations 08 Hours**

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|---|
| Introduction, Types of Publics, Importance of Employee communication, Communication Policy, Organization Culture & Change, media of Employee communications, Rules for effective Employee Relations |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Case studies on Effective means of communication adopted by organizations to motivate employees |

**Module – 4 Community and Media Relations** **08 Hours**

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| Community Relations- Need, Community Relations Process, Corporate Social Responsibility & Philanthropy; Media Relations – Media Relations –Role of Media in Public Relations – Social Media – working with the media –Media Relations Program Elements –Role of Technology in Public Relations. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on Influence of community and Media on PR decision making |

**Module – 5 Crisis Management and PR** **08 Hours**

| |
|---|
| Public relations challenges, Types of Issues, Types of crisis, Crisis Management,<br>People’s reaction at the time of crisis, Role of Communication, Fundamental Guidelines |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Discussion on the real time case on Crisis Management |

**Course Outcomes:**

CO1: Apply fundamental tools of Public Relations practices
CO2: Analyze various emerging trends in the field of Public Relations
CO3: Analyze the importance of Employee communication and Organization change
CO4: Evaluate the importance of Community & Media Relations
CO5: Create a fundamental guidelines of handling issues and crisis Management plan in the Organizations

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Public Relations The Profession and Practice” | Lattimore, Laskin, Heiman & Toth | Tata McGraw Hill | Third edition, , 2012 (LLHT) |
| 2 | “Public Relations Practices – Managerial Case Studies and Problems” Center, , | Jackson, Smith and Stansbury | Prentice Hall of India | Seventh Edition, , 2008 |
| 3 | Public Relations - Paul Baines, | John Egan, Frank Jefkins, Routledge | ISBN - 1136370773, 9781136370779 | 3rd edition, 2007, |
| Reference Books | | | | |
| 1 | Strategic Planning for Public Relations, | Ronald D. Smith Taylor & Francis, | ISBN - 1135606080, 9781135606084 | revised edition 2004 |
| 2 | Public Relations: APractical Guide to the Basics | Philip Henslowe | Kogan Page Publishers, 2003, ISBN - 0749440724, 9780749440725 | 1st edition |
| 3 | Public Relations Practices, Managerial Case Studies and Problems, Allen H Center | Allen H Center, Patrick Jackson, Stacey Smith | Frank R Stansberry | 7th Edition. |

**Semester: IV**

**Course Name: Compensation Management & Reward System**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR405** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**

- Basic knowledge on Compensation and rewards
- Basic Knowledge on MS-Excel
- Familiarize with salary concepts

**Module – 1 Conceptual Frame work of Compensation 08 Hours**

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| Compensation, Meaning of compensation, Total Compensation/Reward and Its Components and Types, Importance of the Total Compensation Approach, Wages/Salaries, Some Other Terms, Theories of Wages, Compensation Strategy, Compensation Policy, The Psychological Contract, Compensation and Legal Issues in Compensation Management, Factors Affecting Employee Compensation/Wage Rates/Wage Structure/Levels of Pay. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Study on the various terms of compensation used in organizations |

**Module – 2 Compensation Management 08 Hours**

| |
|---|
| Meaning of Compensation Management, Essentials of a Satisfactory Wage System, Types of Compensation Management - The Pay Model, Strategic Pay Policies, Strategic Perspectives of Pay, Strategic Pay Decisions, Best Practices vs. Best Fit Options, National Wage Policy in India, Wage Problems in India Divergent Systems and Institutions for Wage Fixation in India. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Find out the revised wage policies of India for various sectors. |

**Module – 3 Wage Determination Practices in India 08 Hours**

| |
|---|
| Introduction, Management's Strategy, Reward Policy, Reward Management Processes, Reward Management Procedures, Pay Reviews, Planning and Implementing Pay Reviews, Procedures for Grading Jobs and Pay, Rates Fixation, Controlling Payroll Costs, Evaluation of Reward Processes, Some Other Trends, Boardroom Pay, Management Strategy; Fringe Benefits, Fringe Benefits and Current Practices, Internal Audit of Compensation and Benefits; Different types of Direct and Indirect compensation include: Base Pay / Base pay; Commissions; Overtime Pay; Bonuses, Profit Sharing, Merit Pay; Stock Options; Travel/Meal/Housing Allowance; Benefits including: dental, insurance, medical, vacation, leaves, retirement, taxes; Merit pay; Incentive Pay; Deferred Pay ; Pay for time; Recreational facilities. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Overview on the types of pay in different organizations |

**Module – 4 Contingent Pay, Pay for Performance, Competence 08 Hours**

| |
|---|
| Competency-Based Pay, Skill-Based Pay, Team-Based Rewards, Gainsharing, Profit-Sharing Profit-Related Pay and Beyond Other Cash Payments and Allowances Overtime Payments Attendance Bonuses, Shift Pay, Clothing Allowances, Honoraria, Payments for Qualifications, Pay for Person, Pay for Excellence, Managerial Compensation and Rewards, Sales Force Incentive Programmes, Competency based Pay- Framework, Model and Challenges; Pay for Performance : Steps involved in the design for pay for performance - Intent ; Eligibility; Participation |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Gather information on competence based pay from various organizations |

**Module – 5 Administration & Controlling Salary Costs and Salary Review 08 Hours**

| |
|---|
| Salary Survey data, Salary Costs, Salary Planning, Salary Budget, Salary Control, Salary Reviews, Guidelines for Salary Review Process, Responding to Negative Salary Review, Five Key Steps: Manager's Guide to Annual Salary Review, Fixing of Salary, Method of Paying Salary, Flexibility, Process of Wage and Salary Fixation. |
| Teaching-Learning Process: |
| Pedagogy: Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>Skill Enrichment Exercise: Study on the administration of salary concepts from any managers in the organizations |

**Course Outcomes:**

CO1: Apply various conceptual aspects of Compensation and Benefits to achieve organizational goals.
CO2: Analyze the strategic perspectives of pay for business excellence.
CO3: Evaluate wage determination practices in organizations in framing wage structure.
CO4: Designing the compensation strategies for attraction, motivation and retaining high quality workforce.
CO5: Communicate Legal & Administrative Issues in global compensation to prepare compensation plan, CTC, wage survey and calculate various bonus.

## Assessment Details

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE**:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Compensation Management | R. C. Sharma, Sulabh | Sage Publication India Pvt. Ltd | 2019 |
| 2 | Compensation and Benefit Design | Biswas, Bashker, D | Pearson | 2013 |
| 3 | Understanding wage systems in India | Sharma, A.M | Himalaya Publishing House | 2009 |
| **Reference Books** | | | | |
| 1 | Human Resource Information Systems: Basics, Applications, and Future Directions | Michael J. Kavanagh, Mohan Thite, Richard D. Johnson | Sage Publication India Pvt. Ltd | 3/e, 2015 |
| 2 | Competency-Based Human Resource Management | Anindya Basu Roy, Sumati Raym | Sage Publication India Pvt. Ltd | 2019 |
| 3 | Compensation and Reward Management | Singh, B D | Excel Books | 2007 |

**Semester: IV**
**Course Name: Talent Management**

| | | | |
|---|---|---|---|
| Course Code | **22MBAHR406** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **2:0:2** | SEE Marks | **50** |
| Credits | **03** | Exam Hours | **03** |
| Total Hours of Pedagogy | **40** | Max Marks | **100** |

**Pre-requisites:**
- Good communication & Presentation skills.
- Awareness of Performance Analysis Tools.
- Basics of HR functions.
- Awareness of Career Management and Succession Planning.

**Module – 1 Talent Management – Introduction 08 Hours**

| |
|---|
| Talent- Engine of New Economy, Difference between Talents and Knowledge Workers, Leveraging Talent, The Talent Value Chain, Elements of Talent Friendly Organizations, Talent Management Process, Talent Management System – Components and Benefits of Talent Management System; Creating TMS, Challenges of TMS, Building Blocks of Talent Management. Competencies – Performance Management, Conducting Performance Reviews, Appraising Executive Talent, Selecting The Right Appraisal. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Discuss Top 5 Talent Friendly Organizations |

**Module – 2 Talent Planning 08 Hours**

| |
|---|
| Concept, Succession Management Process, Integrating Succession Planning and Career Planning, Designing Succession Planning Program, Strategic Accountability Approach in Developing the Workforce, Balanced Scorecard, Talent Development Budget, Contingency Plan for Talent, Building a Reservoir of Talent, Compensation Management within the Context of Talent Management, CEO Succession Planning. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Draft a Succession Planning for CEO |

**Module – 3 Talent Development and Retention 08 Hours**

| |
|---|
| Potential Identification and Development. Coaching for Sustained &Desired Change, Integrating Coaching, Training and Development with Talent Management, Employee Retention- Motivation and Engagement. Return on Talent, Age of Analytics, Making Outplacement as a part of Talent Strategy, Developing Talent Management Information System. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: List out the Employee Retention Strategies implemented by top Corporates |

**Module – 4 Competency Mapping** **08 Hours**

| |
|---|
| Concepts and Definition of Competency; Types of Competencies, Competency based HR Systems, Competency and Performance, 5 Level Competency Model, Developing Various Competency Models, How Competencies Relate to Career Development and Organizational Goals. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Prepare an Employee Career Development Program for an automobile company. |

**Module – 5 Performance Assessment** **08 Hours**

| |
|---|
| Competency Mapping & Performance Assessment: Meaning, Definition, Background and Approaches to Performance Assessment, Competency based Performance Assessment, Diagnosing Reasons for Performance Problems, Designing an Effective Performance Management System, Sources of Errors in Performance Measurement. Assessments Centre: Concepts, Importance and Uses of Assessments Centre in Selecting Employees, Assessment Centre Approach to Competence Building. |
| Teaching-Learning Process: |
| Pedagogy: Lecture, YouTube videos, Group Discussions, Case Study.<br>Skill Enhancement Exercises: Prepare a Competency Dictionary for various positions |

**Course Outcomes:**

At the end of the course the student will be able to:

CO1: Apply the basics of TMS to formulate HR policies and practices in corporate sector.
CO2: Analyze various strategies for developing and retaining best talents for competitive advantage of the organization.
CO3: Evaluate various competency models to relate career development and organizational goals.
CO4: Analyze various methods of competency mapping to evaluate a person’s ability.
CO5: Develop competency based performance management system.

## Assessment Details

**Continuous Internal Evaluation (CIE):**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | **Total Marks** | | | **50** |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Mini Projects, Presentations, Paper Publications, MOOCs, Group Discussion, debate, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Organizational Behaviour: Human Behavior at work | John W. Newstrom and Keith Davis, | Tata McGraw Hill | 11/e, 2003. |
| 2 | Human Relations in organizations | Robert N. Lussier, | McGraw Hill Education | 6/e |
| 3 | Development of Management Skills | Whetten & Cameron, | PHI. | 7/e |
| **Reference Books** | | | | |
| 1 | Understanding OB | Udai Pareek, | Oxford University Press. | |
| 2 | Theories of Personality | Calvin S Hall | Wiley India Pvt. Ltd. | 4/e |
| 3 | Seven habits of highly effective people | Stephen R Covey | Pocket Books | |

# GUIDELINES FOR 6 WEEK PROJECT WORK 22MBAPR407
# (BETWEEN 3RD AND 4TH SEMESTER MBA)

| | | | |
|---|---|---|---|
| Course Code | **22MBAPR407** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:16** | SEE Marks | **50** |
| Credits | **08** | Exam Hours | **00** |

## Objective

To expose the students to understand the working of the organization/company / industry and take up an in- depth study of an issue / problem in the area of specialization.

## General Guidelines

- The project work shall be for a period of 6 weeks immediately after the completion of 3rd SEE but before the commencement of the 4th semester classes.
- The Course code of the project report shall be 22MBAPR407 and shall be compulsory for all the students opting for all specializations.
- The University shall receive 2 copies of project reports prior to the commencement of the 4th semester examination. Copies of the project report should be sent to the concerned COE Office, Ballari Institute of Technology and Management, Ballari with intimation to the COE.
- By keeping the business trend in the present scenario, university has given an option to the students to select the research problem either from business organization or they can carry out the project on freelance basis subject to the approval of department committee.
- It is the total responsibility of the internal guide to monitor the freelance project.
- In case, business problem selected from a Company, no two students of an institute shall work on the same problem in the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.
- On completion of the project work, student shall prepare a report with the following format.
- The Project report shall be prepared using word processor viz. MS Word with New Times Roman, 12 font size.
- All the reports shall be printed in the A4 size 1” margin on all the sides.
- The report shall be hard bound facing sheet of royal blue color indicating the title of college and month &year of admission (spiral binding not permitted).
- A certificate by the guide, HOD and Head of the institution indicating the bonafide performance of the project by the student to be enclosed.
- An undertaking by the student to the effect that the work is independently carried out by him/her.
- The certificate from the organization if applicable (if its Freelance project, certificate is not required and internal guide can issue a certificate for successful completion).
- Acknowledgement
- Executive Summary

**Schedule to be followed before commencement of Project**

| Activity | Timeline | Remarks |
|---|---|---|
| Identifying the organization Problem identification | First week | Student individually identifies an organization OR identifies Problem for his/her study, according to his/her interest. |
| Problem statement Research Design | Second week | His/ Her interests are discussed with project guides. Discussion with Internal Guide to decide on suitable design for the research |
| Synopsis Preparation | Third week | Preparation of Synopsis* & formulating the objectives |
| Presentation of Synopsis | Fourth Week | The student will present the synopsis with the detailed execution plan to the Internal Guide and HOD who will review and may:<br>a. Approve<br>b. Approve with modification or<br>c. Reject for fresh synopsis |
| Approval Status | Fifth & Sixth week | The approval status is submitted to HOD who will officially give concurrence for the execution of the Project |

***Synopsis: Three page hard copy to be submitted to the HOD with the signatures of the Guide and the student**

| | |
|---|---|
| Page 1 | Title, Contact Address of student- with details of Internal and External Guide (if applicable). |
| Page 2 | Short introduction with objectives and summary (300 words). Review of Articles / Literature about the topic with source of information. |
| Page 3 | Time Activity Chart. |

**Schedule to be followed during Project work**

| Activity | Time Line | Remarks |
|---|---|---|
| Understanding Structure, Culture and functions of the organization /identifying of business problem from the Industry from the literature study | First week of Project | Student should understand products/services and the problems of the organization. |
| Preparation of Research design and Research instrument for data collection | 2nd week of Project | Discussion with the guide for finalization of research design and instrument in his/her domain and present the same to the guide. (First Presentation). |
| Data collection | 3rd week of Project | Date collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. (Second Presentation). |
| Analysis and finalization of report | 4th & 5th week of project | Students must use appropriate and latest statistical tools and techniques for analyzing the data. (It is must to use of Statistical Package whose result should be shown in the report) (Third Presentation). |
| Submission of Report | 6th week of Project | Final Report should be submitted to the University before one week of the commencement of theory examination. |

**Project Report Evaluation:**

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by a faculty member of other institute drawn from other institutes with minimum of 10 years' experience
- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective Institution where a student is expected to give a presentation of his/ her work.
- The viva –voce examination will be conducted by the respective HOD / Senior Professor of the department and an expert drawn from the other institutes with minimum of 10 years of experience as appointed by the University.
- Project work carries 100 marks consisting of 40 marks for internal marks by the internal guide, average of 30 marks from both internal and external evaluation and 30 marks for viva-voce examination. Minimum passing marks of the Project work is 50% in each of the components such as Internal Marks, report evaluation and viva-voce examination.
- Format of the project report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1inch margin all sides (1.5inch on left side) and 1.5 line spacing. The Project report shall not exceed 100 pages.
- Submission of Report: Students should submit the Project Report in electronic data form only, in PDF file (Un-editable Format) to the Institute. The Institute in turn shall submit all the CD's of their students along with a consolidated master list as per specialization containing USN, Name of the student, and Title of the Report to COE) one week before the commencement of the Theory Examinations or as per notification given for this purpose.
- Plagiarism: Plagiarism is considered as academically fraudulent, and an offence against University academic discipline. The University considers plagiarism to be a major offence, and subject to the corrective procedures. It is compulsory for the student to get the plagiarism check done before submission of the project report. Plagiarism of up to 25% is allowed in the project work and report should consist 75% of original content/work.
- Publication of Research Findings: Students are expected to present their research findings in Seminars/ Conferences/ Technical/ Management Fests or publish their research work in Journals in association with their Internal Guide. Appropriate Weightage should be given to this in the internal evaluation as well as in the viva voce examination of the project report.

**Contents of the Project Report**

- Cover page
- Certificate from the Organization (scanned copy if applicable)
- Certificate from the guide, HOD and Head of the Institution (scanned copy) indicating bonafide performance of Project by the student
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

**Chapter 1: Introduction**

- Introduction, Industry profile and company profile: Promoters, vision, Mission & Quality Policy. Products / services profile areas of operation, infrastructure facilities, competitor's information, SWOT Analysis, Future growth and prospects and Financial Statement

**Chapter 2: Conceptual background and Literature review**

- Theoretical background of the study, Literature review with research gap (with minimum 20 literature reviews).

**Chapter 3: Research Design**

- Statement of the problem, Need for the study, Objectives, Scope of the study, Research methodology, Hypotheses, Limitations, Chapter scheme.

**Chapter 4: Analysis and Interpretation**

- Analysis and interpretation of the data- collected with relevant tables and graphs. Results obtained by the using statistical tools must be included.

**Chapter 5: Findings, Conclusion and Suggestions**

- Summary of findings, Conclusion and Suggestions / Recommendations

- **Bibliography**: Books, Articles names, etc. to be mentioned as per APA style. Annexure: Relevant to the project such as figures, graphs, photographs etc.

**Rubrics for Project Work (Common to core and Dual Specializations)**

| SN | Particulars | Marks Allotted |
|---|---|---|
| 1 | Internal Assessment by the Guide- Based on three Presentations by Students | 25 |
| 2 | Report Evaluation by the Guide & External Examiner Average Of the marks awarded by the two Examiners shall be the Final evaluation marks for the Dissertation. | 25 |
| 3 | Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/ Institute (Joint Evaluation) | 50 |
| | **Total** | **100** |

**Rubrics for Project Evaluation and Viva voce Examination**

A. Internal Assessment by the Guide- Based on three Presentations by Students

| SN | Aspects | Marks Allotted |
|---|---|---|
| 1 | Introduction and Methodology | 5 |
| 2 | Industry and Company Profile | 5 |
| 3 | Theoretical background of study | 5 |
| 4 | Data analysis and interpretation | 5 |
| 5 | Summary of findings, suggestions and conclusion | 5 |
| | **Total** | **25** |

**A. Report Evaluation by the Guide & External Examiner. Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation.**

| SN | Aspects | Marks Allotted |
|---|---|---|
| 1 | Introduction & Relevance of the project | 5 |
| 2 | Conceptual background and literature review | 5 |
| 3 | Research design | 5 |
| 4 | Analysis and interpretation | 5 |
| 5 | Summary of findings, suggestions and conclusion | 5 |
| | **Total** | **25** |

**B. Viva-Voce Examination to be conducted by the HOD/ Guide and an External examiner from the Industry/ Institute (Joint Evaluation)**

| SN | Aspects | Marks Allotted |
|---|---|---|
| 1 | Presentation skills | 5 |
| 2 | Communication skills | 5 |
| 3 | Subject knowledge | 10 |
| 4 | Objectives of the study and Methodology | 10 |
| 5 | Analysis using statistical tools and statistical packages | 10 |
| 6 | Findings and appropriate suggestions | 10 |
| | **Total** | **50** |

**Formats for Project Report and Evaluation**

- Format of Cover Page
- Format of certificate by Company/Institution or from both
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

(Title of the Report)

Submitted by

(Student Name)
(USN)

Submitted to

Ballari Institute of Technology and Management, Ballari
In partial fulfillment of the requirements for the award of the degree
of

**MASTER OF BUSINESS ADMINISTRATION**

Under the guidance of

| INTERNAL GUIDE | EXTERNAL GUIDE |
|---|---|
| (Name & Designation) | (Name & Designation) (Institute Logo) |

Department of MBA
(Institute Name with Address)
(Month & Year of submission)

# CERTIFICATE

This is to certify that (Name of the Student) bearing USN (xxxx), is a bonafide student of Master of Business Administration Programme of Ballari Institute of Technology and Management, (Autonomous Under Visvesvaraya Technological University).Project report on "(Title of Report)"is prepared by Him/her under the guidance of (Name of the Guide), in partial fulfillment of the requirements for the award of the degree of Master of Business Administration

Signature of Internal Guide Signature of HOD Signature of Principal

## DECLARATION

I, (Student Name), hereby declare that the Project report entitled "(Title)" with reference to – (Organization with place) prepared by me under the guidance of (Guide Name), faculty of M.B.A Department, (Institute name) and external assistance by (External Guide Name, Designation and Organization). I also declare that this Project work is towards the partial fulfillment of the university Regulations for the award of degree of Master of Business Administration by Ballari Institute of Technology and Management, Ballari (Autonomous under VTU). I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place: Signature of the Student
Date:

## Table of Contents


| | Contents | Page No's. |
|---|---|---|
| **Executive Summary** | | |
| Chapter-1 | Introduction | XXXXXXXXX |
| Chapter-2 | Industry and Company profile | XXXXXXXXX |
| Chapter-3 | Theoretical Background of the Study | XXXXXXXXX |
| Chapter-4 | Data Analysis and interpretation | XXXXXXXXX |
| Chapter-5 | Summary of Findings, suggestions and Conclusion | XXXXXXXXX |
| Bibliography | | |
| Annexures | | |


## List of Tables


| SN | Particulars | Page No's. |
|---|---|---|
| 1 | Table showing ABC Analysis | XXXXX |
| 2 | Table showing FSN Analysis | XXXXX |
| 3 | Table showing EOQ | XXXXX |
| 4 | Table showing stock of Raw materials | XXXXX |


List of Figures/ Charts/ Graphs


| SN | Particular s | Page No's. |
|---|---|---|
| 1 | Graph showing ABC Analysis | XXXXX |
| 2 | Graph showing FSN Analysis | XXXXX |
| 3 | Graph showing EOQ | XXXXX |
| 4 | Graph showing stock of Raw materials | XXXXX |


## BIBLIOGRAPHY

**BOOKS:**
Name of the Author, Title of the Book, Name of the Publisher, Edition, year of Publication.

**ARTICLES:**
Name of the Author, Title of the article, Name of the Journal, Volume/Issue Number, Year, Page Number (pp).

**WEBLIOGRAPHY**
Name of the Author, Title of the article. Retrieved on dd/mm/yyyy from URL

## MARKS SHEET FORMATS

### 1. Internal Assessment by the Guide- Based on three Presentations by Students

**Ballari Institute of Technology and Management, Ballari**
**(Autonomous under VTU)**
**Marks Sheet for MBA Project Work**
**(22MBAPR407)**

**Name of the College:** **College Code:**

**Internal Marks Allocation for Project Work (22MBAPR407)**

| SN | Aspects | Marks Allotted |
|---|---|---|
| 1 | Introduction and Methodology | 5 |
| 2 | Industry and Company Profile | 5 |
| 3 | Theoretical background of study | 5 |
| 4 | Data analysis and interpretation | 5 |
| 5 | Summary of findings, suggestions and conclusion | 5 |
| **Total** | | **25** |

**Marks Sheet**

| SN | USN | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |

**Signature of the Internal Guide**
**with Name, Address & Date**

**Note:**

1. Total Internal Evaluation Marks of the Project report should be sent along with the other subject internal marks and the above marks sheet should be maintained by the Department/Institution for verification on demand.
2. Total Internal Evaluation Marks of the Project report should be uploaded to COE Office by the Internal guide after thorough evaluation of the project report and the copy of the mark sheet downloaded after the entry must be maintained in the department as well as sent to COE Office along with the remuneration bill.

### 2. Report Evaluation by the Guide & External Examiner. Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation

**Ballari Institute of Technology and Management, Ballari**
**(Autonomous under VTU)**

**Marks Sheet for MBA Project Work**
**(22MBAPR407)**

**Name of the College:** **College Code:**

**External Evaluation Marks Allocation for Project Work (22MBAPR407)**

| SN | Aspects | Marks Allotted |
|---|---|---|
| 1 | Introduction & Relevance of the project | 5 |
| 2 | Conceptual background and literature review | 5 |
| 3 | Research design | 5 |
| 4 | Analysis and interpretation | 5 |
| 5 | Summary of findings, suggestions and conclusion | 5 |
| | **Total** | **25** |

**Marks Sheet**

| SN | USN | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |

**Signature of External Examiner with affiliation**

**Note:**
1. Total External Evaluation Marks of the Project report should be uploaded to COE Office by the External examiner appointed by COE Office after thorough evaluation of the project report and the copy of the mark sheet downloaded after the entry must be sent to COE Office along with the remuneration bill.

**3. Viva-Voce Examination to be conducted by the HOD/ Guide and an External examiner from the Industry/Institute (Joint Evaluation)**

**Ballari Institute of Technology and Management, Ballari**
**(Autonomous Under VTU)**
**Marks Sheet for MBA Project Work (22MBAPR407)**

**Name of the College:** **College Code:**

**Viva voce Marks Allocation for Project Work (22MBAPR407)**

**(Viva voce conducted by HOD/Internal Guide and an Expert from other institutes.)**

| SN | Aspects | Marks Allotted |
|---|---|---|
| 1 | Presentation skills | 5 |
| 2 | Communication skills | 5 |
| 3 | Subject knowledge | 10 |
| 4 | Objectives of the study and Methodology | 10 |
| 5 | Analysis using statistical tools and statistical packages | 10 |
| 6 | Findings and appropriate suggestions | 10 |
| | **Total** | **50** |

**Marks Sheet**

| SN | USN | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Signature of Internal Exam** **Signature of External Examiner with affiliation**

**Note:** Marks may be finalized based on the joint evaluation by internal examiner and External examine

**Semester: I**

**Course Name: MANAGEMENT AND ORGANIZATION BEHAVIOR**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA11** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites: Basic knowledge on management practices, insights on business operations, basics of psychology.**

**Course objectives:**

1. To emphasis the fundamental concepts and principles of management in business situations.
2. To educate the function and applications of management.
3. To teach the concepts of employee behavior and its importance in organization.
4. To instruct process of group dynamics and managing teams.
5. To familiarize on the dynamics of cultural impact and managing the employee stress.

**Module – 1**

**Introduction to Management**
Definition,Scope of Management,Objectives, functions of management, administration vs. management, Evolution of management thought, types of managers, difference between manager and leader, Henry Mintzberg managerial roles, Managerial Skills, Managerial Competencies, Fayol's Fourteen Principles, Recent trends in Management.

**9hours**(RBT Levels:**L1, L2, L3**)

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

**Skill Enrichment Exercise:** Explore on industry specific management skills required for effective leadership

**Module - 2**

**Functions of Management**

**Planning:** Meaning of planning, Nature of planning, Objectives, Types of Plans & the planning process, MBO, Decision making, Process of decision making, Types, Techniques in decision making.

**Organizing:** organization structure, formal Vs informal organizations, principles of organizations-chain of command, span of control, decentralization Vs Centralization, virtual organizations.

**Directing:** Definitions, Importance, Elements of Directing, and Principles of Directing.

**Controlling:** Need for controlling, Controlling Process, Types of control, Techniques of Managerial Control, Guidelines for Effective Control.

12 Hours (RBT Levels: **L1, L2, L3, L4**)

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars

**Skill Enrichment Exercise:** Perceive the four functions of management & learn how you can develop and use these skills to help advance your education and career goals.

**Module – 3**

**Understanding Organization Behavior**

**Organizational Behavior:** Introduction, definition, fundamental principles of OB, challenges and opportunities, Foundations of Individual Behavior.

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| **Personality-** Meaning, Factors Influencing Personality, Traits of personality, Big Five Personality Traits, Myers–Briggs Type Indicator (MBTI), Personality Tools and Tests.<br>**Perception-**Meaning, Perceptual Process, Factors Influencing Perception, Perception and Decision-making<br>**Attitude –** Meaning, Components, Relation between attitude and behavior, Changing Attitudes in the Workplace.<br>**Motivation:** Definitions, importance of motivation, Process of Motivation (Cycle of Motivation), Types, Theories of motivation, Application of motivational theories.<br>12Hours (RBT Levels: **L2, L3, L4, L5**) |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>**Skill Enrichment Exercise:** Build your OB Toolbox to extend your OB skills, Compare successful companies effective OB practices employed. |

**Module – 4**

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| **Managing Human at Work**<br>**Group Dynamics**- Meaning of Group, Group Characteristics, Classification of Groups, Models of Group Development, Meaning of Group Dynamics, Impact of Group on Individual's Behaviour, Impact of External Factors on Group Behaviour. **Teamwork-** Teams meaning, Team Characteristics, Teams Versus Groups, Teamwork, Processes of Teamwork, Types of Teams, Reasons for Team Failure, Creating Effective Teams.<br>9Hours (RBT Levels: **L2, L3, L4, L5**) |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>**Skill Enrichment Exercise:** Invest in building effective relationships, Teamwork Takes to the Sky: The Case of General Electric. |

**Module – 5**

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| **Organizational Culture and Stress Management**<br>**Culture:** Definitions of Organizational Culture, Characteristics, Types, Levels, Strong versus Weak Culture,Changing, Changing Organizational Culture.<br>**Stress Management-**Definitions, Understanding Stress, Relationbetween Stress and Performance, Level, Signs and Symptoms of Stress, Types of Stress, Causes of Stress,Managing Stress.<br>10Hours (RBT Levels: **L3, L4, L5, L6**) |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method. Power point presentations, videos, group discussion, case study, seminars<br>**Skill Enrichment Exercise:** Recognize the positive and negative aspects of power and politics. Immerse yourself in different cultures & develop openness to different experiences. Focus on Power: The Case of Steve Jobs |

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| **Course Outcomes:**<br>**CO1: Apply** the concepts & principles of management in building manager qualities.<br>**CO2: Analyze** the various functions of management and appropriate its business application. |

**CO3: Evaluate** the OB practices of employees using various personality tools and tests
**CO4: Design** the functioning of Group dynamics and in building effective teams.
**CO5: Develop** various dimensions in creating organization culture and overcome stress management.

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Essentials of Management | Koontz | McGraw Hill | 8e, 2014 |
| 2 | Management and Organizational Behavior | K.Purushothama& H. H Ramesha | Himalaya Publishing House | Latestedition |
| 3 | Organizational behaviour | Stephen P Robbins, Timothy | Pearson | 14e, 2012 |
| Reference Books | | | | |
| 1 | Principles of Management | Ramesh B. Rudani | Tata McGraw-Hill | 2013 |
| 2 | Masters of Management Thought | MahanandCharati& M MMunshi | Swapna Book House | 2015 |
| 3 | Organizational behavior: Amodern approach | Arun Kumar and Meenakshi | Vikas Publishing House | 2011. |
| | | | | |

**e- Resources:**

1. https://www.tandfonline.com/toc/worg20/current
2. https://managementhelp.org/
3. https://openstax.org/details/books/organizational-behavior
4. https://opentextbc.ca/organizationalbehavioropenstax/

**Semester: I**

**Course Name: MANAGERIAL ECONOMICS**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA12** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

- Knowledge of Basic Economic concepts
- Knowledge of Indian Economy
- Knowledge of primary, secondary and tertiary sector

**Course objectives:**

1. To familiarize the fundamentals and theories of managerial economics.
2. To provide insights of demand and elasticity concepts in relation to firm and industry.
3. To teach fundamentals of Production and Cost concepts in Business scenario.
4. To emphasize the concepts of Market structure, Pricing, Profit strategies
5. To Educate the basics of Micro and Macro Economic concepts

**Module – 1**

Managerial Economics: Meaning, Nature, Scope, & Significance, Uses of Managerial Economics, Role and Responsibilities of Managerial Economist. Theory of the Firm: Firm and Industry, Objectives of the firm, alternate objectives of firm. Managerial theories: Baumol's Model, Marris's Hypothesis, Williamson's Model.

10 Hours (RBT Levels: L1,L2,L3)

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method, PowerPoint Presentation, YouTube videos

**Skill Enrichment Exercises:** Learning Insights of Economic Gurus, Case Study

**Module - 2**

Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand –Classification of Price, Income & Cross elasticity, Advertising and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making, Measurement of elasticity of demand. Law of supply, Elasticity of supply, Demand forecasting: Meaning & Significance, Methods of demand forecasting. (Simple problems).

10 Hours (RBT Levels: L1,L2,L3,L4)

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method, PowerPoint Presentation, Using MS –Excel for Problems

**Skill Enrichment Exercises:** Mini Case Study on Demand and Supply Using MS-Excel

**Module – 3**

Concepts of Production, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Least cost combination factor, Economies of scale, Diseconomies of scale. Technological progress and production function. Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve. **Break Even Analysis** – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions (with simple Problems).

10 Hours (RBT Levels:L2,L3,L4,L5)

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method**,** Power point presentation

**Skill Enrichment Exercises:** Problems on BEP Using MS-Excel

**Module – 4**

**Perfect Competition**, Features, Determination of price under perfect competition, Monopoly: Features, Pricing under monopoly, Price Discrimination. Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation. Oligopoly: Features, Kinked demand Curve, Cartels, Price leadership.
**Descriptive Pricing Approaches:** Full cost pricing, Product line pricing, **Pricing Strategies**: Price Skimming, Penetration Pricing, Loss leader pricing, Peak Load pricing.

10 Hours (RBT Levels: L2,L3,L4,L5 )

**Teaching-Learning Process:**

**Pedagogy:** Chalk and Talk method, Power point presentation
**Skill Enrichment Exercises:** Mini Project on Market Structures and Pricing

**Module – 5**

Nature, Scope, Structure of Indian Business Environment – Internal and External Environment. Political and Legal Environment, Economic Environment, Socio – Cultural Environment, Global Environment
**Basic Macro Economic Concepts:** Open and Closed Economies, Primary, secondary and Tertiary sectors and their contribution to the economy. Measuring GDP and GDP Growth rate, Components of GDP.
**Industrial Policies and Structure:** A critical look at Industrial Policies of India, New Industrial Policy 1991; - Private Sector- Growth, Problems and Prospects, SMEs –Significance in Indian economy-problems and prospects. **Fiscal policy and Monetary Policy. Foreign Trade:** Trends in India's Foreign Trade, Impact of WTO on India's Foreign Trade.

10 Hours (RBT Levels:L3,L4,L5,L6)

**Teaching-Learning Process:**

**Pedagogy:** Chalk and Talk method, YouTube videos, Power point presentations
**Skill Enrichment Exercises:** Budget Analysis

**Course Outcomes:**
CO1: To apply the basic concepts of managerial economics in business Scenario.
CO2: To analyze the nature of demand and supply conditions to firm and industry.
CO3: To evaluate the Production and Cost strategies with business environment.
CO4: To design the strategies for Market competitions and Profit analysis.
CO5: To communicate the micro and macroeconomic concepts with reference to firm and industry.

**Assessment Details**

**CIE :**

| | | | | |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be

proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 80 percent theory and 20 percent problems in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Managerial Economics | Geethika, Ghosh & Choudhury | McGraw Hill | 2/e, 2011 |
| 2 | Managerial Economics | D.M Mithani | HPH | 2016 |
| Reference Books | | | | |
| 1 | Managerial Economics | R. Panneerselvam, P. Sivasankaran, P. Senthilkumar | Cengage | 2015 |
| 2 | Managerial Economics | H.L Ahuja Samuelson & Marks | S.Chand | 2014 |
| 3 | Managerial Economics | Samuelson & Marks | Wiley | 5/e, 2015 |

**e-Resources:**

1. https://www.youtube.com/watch?v=RaXQ8wQ6TUs
2. https://www.youtube.com/watch?v=g_Q_agzFXi0
3. https://www.youtube.com/watch?v=ycyMktNFZ88
4. https://www.youtube.com/watch?v=vLPpF0hunwc

**Semester: I**

**Course Name: ACCOUNTING FOR MANAGERS**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA13** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

- Basic Knowledge of mathematics.
- Fundamentals of Economics.
- Awareness of business scenario.
- Awareness of Government policies

**Course objectives:**

1. To understand the fundamental accounting concepts, need for accounting & Ind AS.
2. To explain the concepts of business transactions for identifying , recording & posting.
3. To prepare basic financial statements using the modern formats of Companies Act.
4. To describe the application of tools for measuring the company's financial statements using MS-Excel.
5. To utilize the concepts of standard costing and variance analysis for managerial decision making.

**Module – 1**

**Introduction to Accounting:**
Financial Accounting: Meaning and Need for accounting, Types of Accounting, Concepts and Conventions of Accounting, Concept of expenses& income ;capital and revenue, Ind-AS.

**6 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

**Pedagogy:** PowerPoint Presentation,Case Study.
**Skill Enrichment Exercises:** Visit the ICAI websites and study and analyze various AS and IFRS.

**Module - 2**

**Accounting –recording, classifying &analyzing:**
Journal, Ledgers, differences between journal and ledger, Trial balance, differences between trial balance and balance sheet. Bank reconciliation Statements-concept and analysis.

**10 Hours (RBT Levels: L1,L2,L3,L4)**

**Teaching-Learning Process:**

**Pedagogy:** PowerPoint Presentation,Case Study.
**Skill Enrichment Exercises:** Collect the information from Bank Passbook and Cash book details and learn the process of BRS.

**Module – 3**

**Financial Statements:**
Concept of financial statements, Income Statements, Balance Sheets, adjustments of financial statements. Concept of Window dressing. Preparation of final accounts of companies in vertical form as per Companies Act of 2013.

**10 Hours (RBT Levels: L2,L3,L4,L5)**

**Teaching-Learning Process:**

**Pedagogy:** PowerPoint Presentation,Case Study.
**Skill Enrichment Exercises:** Visit various company websites and download previous year question papers to understand the formats to prepare the financial statements.

**Module – 4**

**Analysis of Financial Statements:**
Meaning and Purpose of Financial Statement Analysis, Financial Ratio Analysis and Cash flow Statement (indirect method).

**10 Hours (RBT Levels:L2,L3,L4,L5,L6)**

**Teaching-Learning Process:**

**Pedagogy:** PowerPoint Presentation,Case Study.
**Skill Enrichment Exercises:** Individual student should analyze the Balance sheets of blue chip companies using Excel sheet.

**Module – 5**

**Accounting for managerial decision making:**
Scope, Purpose of Management Accounting;
**Marginal costing**–concept and areas of application of marginal costing (theory only)
**Standard costing**-Theory& application in Managerial Decision-Making.

**12 Hours (RBT Levels: L2,L3,L4,L5,L6)**

**Teaching-Learning Process:**

**Pedagogy:** PowerPoint Presentation,Case Study.
**Skill Enrichment Exercises:** Individual student should collect the data relating to Variance analysis & make appropriate decisions.

**Course Outcomes:** At the end of the course the student will be able to:
CO1: Apply theoretical knowledge of accounting for relevant business transactions.
CO2: Analyze the transactions using accounting process in business.
CO3: Preparation & evaluation of financial statements of varied companies.
CO4: Design the Cash flow statements & analyze the ratios using MS-Excel
CO5: Communicate the financial situation of business units using Variance analysis

**Assessment Details**

**CIE :**

| | | | | |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, SelfE-Learning withCertifications and other cooperative and problem based learning.

**SEE:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Accounting for Management-Text & Cases | S.K.Bhattacharya& John Dearden | Vikas Publishing House Pvt. Ltd. | 3e, 2018 |
| 2 | Financial Accounting | S.N.Maheshwari, Suneel K. Maheshwari, Sharad K. Maheshwari | Vikas Publishing House Pvt. Ltd. | 6e, 2018 |
| 3 | Computerized Accounting | NeerajGoyal, RohitSachdeva | Kalyani Publishers | 1e, 2018 |
| Reference Books | | | | |
| 1 | Accounting for Managers | J.MadeGowda | Himalaya Publishing House | le, 2007 |
| 2 | Financial Accounting for Management | N. Ramachandran, Ram Kumar Kakani. | McGraw Education (India) Private Limited | 4e., 2016 |
| 3 | Management Accounting: Text, Problems and Cases | MY Khan, PK Jain | Tata McGraw-Hill Education | 7e, 2007 |
| 4 | Accounting and Finance for Non finance Managers | Jai Kumar Batra | Sage Publications | le, 2018 |
| | | | | |

**e-Resources:**

1. **https://www.icai.org/post.html?post_id=17757**
2. **https://www.icai.org/post/icai-e-journal-main**
3. **https://www.icai.org/post/accounting-standards**
4. **https://www.ifrs.org/groups/international-accounting-standards-board/**
5. **https://icmai.in/icmai/index.php**
6. **https://www.aicpa.org/topic/accounting-financial-reporting**
7. **https://www.youtube.com/watch?v=cPhGI-in-bw**
8. **https://www.youtube.com/watch?v=76gMXQBnbps**
9. **https://www.youtube.com/watch?v=aE4JnjAx2Qc**
10. **https://www.youtube.com/watch?v=I0RiMWUCQ24**
11. **https://www.youtube.com/watch?v=0WgqlOAmdnc**

**Semester: I**

**Course Name: BUSINESS STATISTICS**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA14** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:** Familiar with Basic mathematical knowledge, Basic Logical reasoning and analytical thinking, communication and presentation skills.

**Course objectives:**
1. To teach the importance of descriptive statistics for various business data.
2. To educate the process and importance of correlation and regression in business.
3. To give insights on time series methods and its applications.
4. To familiarize the concepts of Hypothesis testing for inferential research findings.
5. Demonstrate the statistical tools for business situations using MS Excel.

**Module – 1**

| |
|---|
| **Introduction of Statistics**: Meaning, Function, Scope of statistics in business and industry, Measures of Central Tendency: Mean, Median Mode, Geometric mean, Harmonic mean. **Measures of Dispersion:** Concept of dispersion Absolute and relative measures of dispersion Range Coefficient of dispersion Quartile deviation mean deviation, variance, and standard deviation, respective absolute and relative measures. Application of measures of central tendency and dispersion for business decision making. .**10 Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method, Case Study, Power point presentation, Solving Practical Problems. **Skill Enrichment Exercises:** Collecting real time data to measures of central tendency (mean, median & mode) |

**Module - 2**

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|---|
| **Correlation &Regression:** Correlation, Types of correlation, Pearson's coefficient of correlation, Spearman's rank correlation coefficient, Properties of correlation coefficient, Regression: Meaning and types of regression equations, Derivation of regression equations, Properties of regression equations, regression of Y on line X & regression of X on Y. **10 Hours (RBT Levels: L1, L2, L3, L4)** |
| Teaching-Learning Process: |
| **Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation, Solving Practical Problems **Skill Enrichment Exercises:** Collect industry data and analyze using correlation and regression. |

**Module – 3**

| |
|---|
| **Time Series Analysis**: Objectives, Variations In Time Series - Methods of Estimating Trend: Freehand Method - Moving Average Method - Semi-Average Method - Least Square Method. Methods of Estimating Seasonal Index: Method Of Simple Averages - Ratio To Trend Method - Ratio To Moving Average Method. **10 Hours (RBT Levels: L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method, Group discussion, Case study, Power point presentation, |

Solving Practical Problems
**Skill Enrichment Exercises:** Forecast sales and stock price trends using time series analysis.

**Module – 4**

**Testing of Hypothesis:**Hypothesis testing: Null and Alternative Hypotheses; Type I and Type errors; Testing of Hypothesis: one sample and two sample tests for means and proportions of larg samples (Z-test), one sample and two sample tests for means of small samples (T-test), F-test f two sample standard deviations. ANOVA: one-way and Two-way (Theory only)

**10 Hours (RBT Levels: L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation, Solving Practical Problems
**Skill Enrichment Exercises:** Formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information.

**Module – 5**

**Computer Lab for Statistics**: MS Excel: Introduction, layout of the excel application, Functions, Formulas, Data analysis using MS-Excel- Mean, Median, Mode, Geometric Mean, Harmonic mean, Standard Deviation, Correlation.

**10 Hours (RBT Levels: L3, L4, L5, L6 )**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk method, , Power point presentation, Solve Practical Problems in computer Lab
**Skill Enrichment Exercises:** Students should undertake a mini project and generate the report using MS Excel.

**Course Outcomes:**
CO1: Apply the basic concepts of descriptive statistic techniques to visualize data systematically.
CO2:Analyze the business situations with appropriate use of decision making techniques.
CO3:Evaluate the business scenarios to predict solution by using time series techniques.
CO4: Design the research process for appropriate data analysis for inferential decisions.
CO5:Develop the various business application and models by the use of MS Excel tools.

**Assessment Details**

**CIE :**

| | | | | |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.

- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Fundamentals of Statistics | S C Gupta | Himalaya Publications | 2012 |
| 2 | Research Methodology | Ranjit Kumar | Sage Publications | 2018 |
| 3 | Parametric and Non Parametric Statistics | VimalaVeeraraghavan and Suhas | Sage Publication | 2017 |
| Reference Books | | | | |
| 1 | Statistical Methods | Dr. S P Gupta | Sultan Chand Publications | 2014 |
| 2 | Research Methodology | C R Kothari | ViswaPrakasam Publication | 2015 |
| 3 | Business Research Methods | S.N.Murthy and U.Bhojanna. | Excel Books | 2016 |

**e-Resources:**

1. http://103.5.132.213:8080/jspui/bitstream/123456789/1103/1/Business%20Statistics%20%28%20PDFDrive.com%20%29%20%282%29.pdf
2. http://103.5.132.213:8080/jspui/bitstream/123456789/1103/1/Business%20Statistics%20%28%20PDFDrive.com%20%29%20%282%29.pdf
3. https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/IntroductoryBusinessStatistics-OP.pdf
4. https://mba.ind.in/forum/business-statistics-notes-mba-free-download-415321.html
5. https://onlinecourses.nptel.ac.in/noc20_mg23/preview

**Semester: I**

**Course Name: Marketing Management**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA15** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:** Students should have basic knowledge of

- Market and business awareness
- Language Proficiency
- Good Communication and Presentation Skills
- Logical Reasoning

**Course objectives:**

1. To share basic fundamental concepts and importance of marketing & its relation to business environment.
2. To teach the insights on the concepts and factors influencing the consumer behavior and purchase decision making.
3. To familiarize the fundaments and use of segmentation, targeting and positioning as a marketer.
4. To educate the principles and elements affecting the pricing and marketing channel strategies.
5. To expound the significance of market promotional strategies to design the campaigns for products and services.

**Module – 1**

| |
|---|
| **Introduction to Marketing:** Nature and scope of marketing, Evolution, Various marketing orientations, Marketing Vs. Selling concepts, Consumer need, Want and demand concepts, Marketing Environment – Assessing the impact of micro and macro environment. Marketing challenges in the globalized economic scenario, Techniques used in Environment Analysis.<br>**Market Basic Concepts:** Customer value, Customer cost & its components, green marketing and green economy, Marketing Myopia, 3VconceptsofNirmalayaKumar, Emerging areas- Neuro Marketing, Sensory Marketing-conceptsonly, Corporate Social Responsibility, Social Responsibility of marketing.<br>**10 Hours (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.<br>**Skill Enrichment Exercises:**To Assess the micro & macro environmental analysis of various firms. |

**Module - 2**

| |
|---|
| **Analyzing Consumer Behaviour:** Buying motives, Factors influencing buying behaviour, Buying habits, Buying Roles, Stages in consumer buying decision process, Types of consumer buying decisions, The black box model of consumer behaviour, B2BmarketingVs.ConsumerMarketing<br>**10 Hours (RBT Levels: L1, L2, L3, L4)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.<br>**Skill Enrichment Exercises:**Analysis of consumer behaviour traits based on miniature projects. |

## Module – 3

**Market Segmentation, Targeting, Positioning & Branding:**

**Segmentation:** Meaning, Factors influencing segmentation, Market Aggregation, Basis for segmentation, Segmentation of Consumer and Industrial markets. **Targeting:** Meaning , Basis for identifying target customers, Target Market Strategies, **Positioning:** Meaning, Product differentiation strategies, Tasks involved in positioning **Branding:** Concept of Branding, Brand Types, Brand equity, Branding Strategies.

**10 Hours (RBT Levels: L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:**Conceptualization of STP through MS Excel.

## Module – 4

**Product/Service Decisions, Pricing Decisions & Marketing Channels:**

**Product/Service Decisions:** Concept, product hierarchy, New product development, diffusion process, Product Life cycle, Product mix strategies. Packaging / Labeling: Packaging as a marketing tool, requirement of good packaging, Role of labeling in packaging. ServicesMarketing&itsCharacteristics-tasksinvolvedinservicemarketing.
**Pricing Decisions:** Significance of pricing, Pricing strategies, New product pricing – Price Skimming & Penetration pricing, PricingProcedure.
**Market Channel:** Meaning, Purpose, Channel alternatives, Factors affecting channel choice, Channel design and Channel management decisions, Channel conflict, Distribution system, Multilevel Marketing(Network Marketing)

**10 Hours (RBT Levels: L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:**Practical orientation on the new product development practices followed by various firms.

## Module – 5

**Promotional Decisions & Strategies:**

**Integrated Marketing Communications:** Concept of communication mix, steps in developing effective communication, Stages in designing message **Advertising:** Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model **Sales Promotion:** Sales Promotion Mix, Tools and Techniques of sales promotion, Push-pull strategies of promotion. **Personal selling:** Concept, Features, Functions, Steps/process involved in Personal Selling, Publicity / **Public Relation:** Meaning, Objectives, Types, Functions of Public Relations **Direct Marketing:** Meaning, Features, Functions,
**Database Marketing:** Basic concepts of e-commerce, e-business, e-marketing, m-Commerce, m-marketing, e-networking, CRM, MkIS, Digital marketing communications, Traditional Vs. Modern Media- Online and Mobile Advertising.
**Marketing Planning:** Meaning, Steps involved in Marketing planning. Marketing Audit- Meaning, components of Marketing Audit.

**10 Hours (RBT Levels: L3, L4, L5, L6)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:**Analyze the relevant advertisements and find its effectiveness using the

procedural method of DAGMAR Approach.

**Course Outcomes:** At the end of the course the student will be able to:

CO1: Access the business scenario and apply the fundamental concepts of marketing to aid business solutions.
CO2: Analyze various models of consumer buying behaviour for better visualization of customer traits.
CO3: Evaluating segmentation, targeting and positioning strategies to implement in business situation.
CO4: Design the implementation of commercial and distribution aspects of products and service.
CO5: Communicate the viable marketing campaign by appropriate marketing strategy.

**Assessment Details**

**CIE :**

| | | | | |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to50.

1. The question paper will have 8 full questions carrying equal marks.
2. Each full question is for 20 marks.
3. Each full question will have sub question covering all the topics under a Module.
4. The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
5. 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Marketing Management-IndianContext,GlobalPerspective. | Ramaswamy &Namakumari | SAGE | 6th Edition |
| 2 | MarketingManagement:ASouth AsianPerspective. | Kotler, Keller, Koshy & Jha | PearsonEducation | Latestedition |
| 3 | Marketing Management | Karunakaran | Himalayan Publication | Latest Edition |
| 4 | NewProductManagement | Merle Crawford and Anthony Di Benedetto | McGraw-Hill | LatestEditon |
| 5 | AdvertisementBrands&ConsumerBehaviour | Ramesh Kumar | SagePublications | 2020 |
| Reference Books | | | | |
| 1 | MarketinginIndia:TextandCases | NeelameghamS | Vikas | Latestedition |
| 2 | Marketing | Lamb,Hair,McDanniel | CengageLearning | Latestedition |
| 3 | FundamentalsofMarketingManagement, | Etzel M J BJ Walker &WilliamJStanton | TataMacgrawHill | Latestedition |
| | | | | |

**e-Resources:**

https://www.routledge.com/Marketing-Management-Text-and-Cases/Stevens-Loudon-Wrenn/p/book/9780789002907
http://link.galegroup.com/apps/pub/8OHU/GVRL?u=ggusf_main&sid=GVRL
https://ebookcentral.proquest.com/lib/gguu-ebooks/detail.action?docID=4461937
https://www.classcentral.com/course/swayam-marketing-management-i-5308
https://www.classcentral.com/course/swayam-marketing-management-ii-12989
https://online-degree.swayam.gov.in/dyp20_d01_s2_mg10/preview

**Semester:I**

**Course Name: Managerial Communication**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA16** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**Students should have

- Basic Knowledge of MS-Office
- Basic Reading fluency
- Moderate Vocabulary Knowledge

**Course objectives:**

1. To familiarize the principles and process, barriers of communication skills
2. To impart the concepts of oral communication and presentation skills.
3. To educate the mechanics of writing and procedure to draft business letters precisely.
4. To explain the importance and uses of Business report and Methodology of business case study.
5. To aid in educating the procedures and process of managerial meeting and presentation.

**Module – 1**

**Introduction:** Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication. Communicating within Organizations – Levels of communication, Communication flow, Communication barriers, Communication in a cross-cultural setting.

**Language Skills : Introduction, four skills of language- Reading, Speaking, Writing, Listening, Importance of Language skills**

**9 Hours (RBT Levels: L1,L2,L3)**

**Teaching-Learning Process:**

**Pedagogy:**Chalk and Talk Method,Power pointPresentation, Youtube videos, Class room activity.

**Skill Enrichment Exercises:** Class room activity to understand the barriers of communication, flow of communication.

**Module - 2**

**Oral Communication:** Meaning – Principles of successful oral communication, Conversation control –Reflection and Empathy: two sides of effective oral communication.

**Oral Presentation:** Role of business presentations, Planning and Organizing Presentation, Planning Team and Online Presentations, Developing Visual Support for Business presentation (PPT Presentation), Practicing and Delivering Presentation - Refining your delivery.

**10 Hours (RBT L1, L2, L3, L4)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and Talk Method,Power pointPresentation, You tube videos, Class room activity.

**Skill Enrichment Exercises:** Students have to prepare presentations on business topics

**Module – 3**

| |
|---|
| **Written Communication:** Purpose of writing – Clarity in writing –Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication Pre writing – Writing – Revising.<br>**Types of Written Communication in Business:** Business Letters, Employee Reviews, Recommendation Letters,<br>Thank You Letters, Memos, proposals and Reports, Press Releases and E-mail.<br><br>**11 Hours (RBT L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method,Power pointPresentation, You tube videos.<br>**Skill Enrichment Exercises :** Drafting letters |

**Module – 4**

| |
|---|
| **Business Reports:** Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports Writing, writing executive summary.<br>**Business Case Analysis:** What is a case? Characteristics of Case and its Analysis, Process of Case Analysis, Requirements of Case analysis, The structure of written casesanalysis.<br><br>**10 Hours (RBT L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method,Power pointPresentation, You tube videos, Case Study Analysis in classroom.<br>**Skill Enrichment Exercises**: Prepare the typical Business Reports and sketch the Case study analysis procedure. |

**Module – 5**

| |
|---|
| **Employment communication:** Putting your best self forward, Preparing your resume, Writing covering letters and Inquiry Emails, Preparing for a Job Interview, Conducting Yourself during the Interview, Following up throughout the process, Practicing business etiquette.<br>**Group Communication:** Meetings – Planning meetings – objectives – participants – timing – venue of meetings.<br>**Meeting Documentation:** Notice, Agenda, and Resolution &Minutes.<br><br>**10 Hours (RBT L3, L4, L5, L6)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method,Power pointPresentation, You tube videos, Class room activity.<br>**Skill Enrichment Exercises:** Drafting Job application and resume. Practicing interview etiquettes. |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: To apply the communication skills for the business correspondence.
CO2: To analyze various types business presentation and adopt appropriate oral communication.
CO3: To evaluate various business letters for communication and structure the appropriate writing skills.
CO4: To draft business reports to meet the challenges of competitiveenvironment.
CO5: To develop interpersonal communication skills in varies business situation for creating business values.

**Assessment Details**

**CIE :**

| | | | | |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Communicating in Business | Ober Newman | Cengage | 8th Edition, 2018 |
| 2 | Managerial Communication | Rai & Rai | Himalaya publishing house pvt.ltd. | 2nd Edition, 2008 |
| 3 | Business Communication | P D Chaturvedi MukeshChaturvedi | Pearson | 3rd Edition, 2013 |
| Reference Books | | | | |
| 1 | Communicating in Business | Williams,Krizan Logan,Merrier | Cengage Learning | 8th Edition, 2017 |
| 2 | Business Communication: Process | Mary Ellen Guffey | Cengage Learning | 3rd Edition, 2002 |
| 3 | Business Communication | Lesikar,Flatley,Rentz ,Pande | TMH | 11th Edition, 2011 |
| | | | | |

**e-Resources:**

| | |
|---|---|
| VTU E- learning centre | http://elearning.vtu.ac.in/ |
| National Digital Library | https://ndl.iitkgp.ac.in/ |
| Knowledge Academy | https://www.theknowledgeacademy.com/in/courses/communication-skills-training/ |

**Semester: 1st**

**Course Name: BUSINESS ENGLISH**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA17** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **2:0:0** | **SEE Marks** | **50** |
| **Credits** | **02** | **Exam Hours** | **03** |

**Pre-requisites:** 1. Knowledge of Basic English Grammar,
2.Basics of Computer knowledge
3. Familiar with basics of Etiquettes

**Course Objectives:**

1. To enable the students to become aware with presentation skills and built potential for organizing meetings.
2. To enable students for emulate the business etiquettes in business meetings and correspondence.
3. To enhance students to acquainted with body language practices.
4. To prepare students to develop the skills of leadership.
5. To comprehend students towards Interview skills.

**MODULE – 1**

**PRESENTATION SKILLS:**Introduction, Meaning, Definitions, Types of Presentation, Organizing Presentations, Presentation Preparation for Successful Presentation, Meeting Running a Meeting Opening a Meeting, controlling a Meeting, International Meetings, Evaluating of a Meeting. Excises on the choice of appropriate grammatical words

**10 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings

**Skill Enrichment Exercises:**Presentation by students on selected topics and reporting.

**MODULE - 2**

**BUSINESS ETIQUETTES:** Introduction, Meaning, Definition, Types of Etiquettes, Rules of Business etiquettes Greetings, Farewells, Invitations Giving Requests, Advice, Recommendations Offers, Instructions, Orders, Apologies, Regret, Gratitude, Asking the Way, Making Accommodations in Hotels, Choosing Meals, the ABC of Table Manners, Telephoning, Making Appointments by Phone.

**10- Hours (RBT Levels:L1, L2, L3, L4)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation. Video Clippings

**Skill Enrichment Exercises:**Collect and Present the various forms of corporate business etiquettes

**MODULE – 3**

| |
|---|
| **BODY LANGUGE**: Defining Body Language, Scope and Relevance, Changing Contours, Classification,Defining Proxemics, Four Zones, Behavioral Connotations, Space and Designs, Haptics and its Role, **Behavioral Significance**: Shaking Hands and other tactile behavior. Cultural Variations, Occulesics, Right and Left Brain Associations, Different Types of Eye Contact, Individual and Group situations, Facial Expressions, Smiles and Nods, Head Tilts and Inclines Facial Expressions, Cultural Interface. **Kinesics:** Types and Contexts, Negative and Positive Gestures, Hand Movements and Steeping, Understanding Finger Movements, Fidgeting Paralanguage and Voice Modulations, Chronemics, Chromatics, Cultural and Gender Based aspects, Stereotypes, **10 Hours (RBT Levels: L1, L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings. **Skill Enrichment Exercises:**Role play on various body language gesture |

**MODULE – 4**

| |
|---|
| **GROUP DISCUSSION**: Introduction, Meaning, Definition, Scope of Group discussion, objectives and purposes of Group Discussion, various phases of group discussion, participating rules in a group discussion, Group discussion tips, facilitating a group discussion. **10 Hours (RBT Levels: L3 L4, L5, L6)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings. **Skill Enrichment Exercises:**Participation on various topics in Group discussion |

**MODULE – 5**

| |
|---|
| **INTERVIEW SKILLS**: Introduction, Meaning, Definition, Types of Interviews, Basic rules of Interview, how to face interview with confidence, Basic interview etiquettes **10 Hours (RBT Levels: L3, L4, L5, L6 )** |
| **Teaching-Learning Process** |
| **Pedagogy:** Chalk & Talk method, Group discussion, Case Study, Power point presentation, Video Clippings. **Skill Enrichment Exercises:**Conduct of mock interviews and role plays |

**Course Outcomes:**
**At the end of the course the students will…**
CO1: Apply then skills sets of presentation and built their potentiality for organizing meetings
CO2: Able to analysis business situation for behavior of business etiquettes.
CO3: Apply the habits of different body languages exposure during business communication
CO4: Analyze the business situation for show up leadership qualities.
CO5: Ability to demonstrate the skills sets for facing Interview.

**Assessment Details**

**CIE :**

| | | | | |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Elementary Market Leader | David cotton David Falveysimonkant | Pearson | 3ed 2012 |
| 2 | Business English | MdEifafithMd Bashir Elmagrabhi Dr fatihelelahmd Ahmed Mohamed | Alrushed book shoe edition | 1st edition 2018 |
| 3 | Presentation Skills for students | Journvan Emden and Lucinda Becker | Macmillan study skills | 3rd 2012 |
| Reference Books | | | | |
| 1 | Master the Group discussion and personal interview | SheetalDesarda | Notion press | 1st Edition 2015 |
| 2 | The definition of body language | Allah and Barbara Pease | Alrushed book shoe edition | 1st edition 2004 |
| 3 | The Essential Job Interview Handbook | Journvan Emden and Lucinda Becker | Jaico Publishing House | 3rd 2012 |

**E-Resources:**

**https://www.coursera.org/courses?languages=en&query=business+englihttps ://www.gymglish.com/en/sh**

**https://www.businessenglishpod.com/**

**http://www.businessenglishresources.com/**

**Semester: II**

**Course Name: HUMAN RESOURCE MANAGEMENT**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA21** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

- Fundamentals of Management
- Basics of Accounting
- Understanding of firm, industry and sectors of economy

**Course objectives:**

1. To familiarize the theories and various functions of Human Resources Management
2. To teach the importance and functions of HR Planning, Acquisition and Employee Training.
3. To educate about significance of employee performance evaluation and compensation.
4. To give insight about the HR Practices for service sector units and small and medium enterprises.
5. To emphasize on the importance of innovative HR Practices

**Module – 1**

| |
|---|
| Human Resource Management and Personnel Management, The Importance of Human Resource Management, Models of Human Resource Management, Evolution of Human Resource Management, HRM in India, The Factors Influencing Human Resource Management , Human Resource Management and Line Managers, The HR Competencies, Human Resource Management and Firm Performance. **10 hours (RBT L1, L2, L3)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk method, PowerPoint Presentation, Group Discussion.<br>**Skill Enrichment Exercises:** Study of HR Department in different industry |

**Module - 2**

| |
|---|
| Human Resource Planning: Importance of HR Planning, Manpower Planning to HR Planning, Factors Affecting HR Planning, Benefits of HR Planning, HRP Process, Tools for Demand Forecasting, Attributes of an Effective HR Planning, Barriers to HR Planning, The Challenges for HR, Process of Job Analysis and Job Evaluation.<br>**Recruitment and Selection:** Importance of Recruitment, Recruitment Policies, Factors Influencing Recruitment, Recruitment Process, Sources, Evaluation of Recruitment Process, Recruitment Strategy ; Selection, Future Trends in Recruitment; Selection Process; Selection Tests; Factors Influencing Selections, Challenges in Selection, Application Tracking System using MS-Excel<br>**Learning, Training, and Development:** Training, Learning and Development, Learning Theories, The Future of Training, Learning, and Development: Crystal Gazing into the Future, World of Learning. Process of training and Techniques of Training.<br>**12 hours (RBT L1, L2, L3, L4)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk method, Power Point Presentation, Group Discussion, Case discussion.<br>**Skill Enrichment Exercises:** Study of different recruitment online portals |

**Module – 3**

| |
|---|
| **Performance Management and Appraisal:** Objectives of Performance Management, Performance Management and Performance Appraisal, Common Problems with Performance Appraisals, Performance Management Process, Types of Performance Rating Systems, Future of Performance Management. **Compensation and Benefits** Introduction, Definitions, Total Compensation, 360 Degree appraisal, HR Mapping Total Rewards System, Forms of Pay, Theories of Compensation, External Factors, Internal Factors, Establishing Pay Rates, Employee Benefits. **10 hours (RBT L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk method, Power Point Presentation, Case discussion.<br>**Skill Enrichment Exercises:** Study of employee benefits offered by various business units. |

**Module – 4**

| |
|---|
| **Human Resource Management in Small and Medium Enterprises**: Definition of SMEs, Human Resource Management and Performance in SMEs, The Difference in Adoption of Human Resource Management: SMEs and Large Firms, Indian Experience, Impact of Weak Adoption of Human Resource Management in SMEs, Factors Influencing the Adoption of Human Resource Management Practices in SMEs, Future of Human Resource. Management in SMEs.<br>**Human Resource Management in the Service Sector**<br>Introduction, The Emergence of the Services Sector, Implications for Human Resource, Management Function, Differences Between Services Sector and the Manufacturing Sector, Difference in Human Resource Management Practices in Services and Manufacturing Sectors, Human Resource Management and Service Quality Correlation, Some Specific Industries in Services Sector, Trade Unions in Services Sector, Models of Union Strategies.<br>Case Study on “Training Program at ABC Cement”.<br>**Enterprises 10 hours (RBT L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk method, Power Point Presentation, Group Discussion.<br>**Skill Enrichment Exercises:** Exploratory study with an executive of an SME |

**Module – 5**

| |
|---|
| **Human Resource Management Innovations:** Introduction, Employee Life cycle Management, Employee engagement, Human Resource Management and Innovations, Factors Affecting the Innovation Process in Organizations, Characteristics of Human Resource Management Innovations, Conditions Necessary for Successful HRMI Implementation, Current Trends in Human Resource Management Innovations, Innovative Human Resource Management Practices in India, How Human Resource Management Practices Contribute to Organizational Innovation, How to Make Human Resource Management Innovations Sustainable.<br>**8 hours (RBT L3, L4, L5, L6)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk method, Power Point Presentation, Group Discussion, Case discussion<br>**Skill Enrichment Exercises:** Overview of the current trends in HR Domain special attention to IT Facilitation |

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Apply the concepts of HRM in an Organization.
CO2: Analyze the various methods of collecting data for HRP, Acquisition, and Development of Human Resource.
CO3: Evaluate the effectiveness of performance management and structure the best possible employee benefits.
CO4: Design the best possible HR Practices for service sector units and small and medium enterprises.
CO5: Construct the appropriate and innovative HR Practices for better workplace.

**Practical Component:**
A visit to an Organization and interact with HR Manager and list out the roles played by HR manager.
Meet Recruitment Manager and ask- 10 questions one asks during Interview.
Meet Training and Development Manager and list out various training given to employees; basis of training program; Need analysis.
Visit any Service Organization. Observe HR functions and List them.

**CO-PO MAPPING**

| CO | PO | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | **3** | **2** | | | |
| CO2 | **2** | **3** | | | |
| CO3 | | | **3** | | |
| CO4 | | | | **3** | |
| CO5 | | | | | **2** |

**Assessment Details**

**CIE:**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**
The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Human Resource Management: Theory and Practices, | R. C. Sharma, Nipun Sharma | Sage Publication India Pvt. Ltd. | 2019 |
| 2 | Human Resource Management: Concepts | AmitabhaSengupta | Sage Publication India Pvt. Ltd. | 2019 |
| 3 | Performance Management and Appraisal Systems HR Tools for Global Competitiveness | T. V. Rao | Sage Publication India Pvt. Ltd. | 2004 |
| Reference Books | | | | |
| 1 | The HR Scorecard: Linking People, Strategy, and Performance | Brian Becker, Dave Ulrich, and Mark A. Huselid | Harvard Business School Press | 2001 |
| 2 | The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals | Shawn Smith and Rebecca Mazin | AMACOM | 2011 |
| 3 | Managing Human Resources in Small and Medium-Sized Enterprises Entrepreneurship and the Employment Relationship | Robert Wapshott, Oliver Mallett , | Routledge | 2015 |
| 4 | The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals | Shawn Smith and Rebecca Mazin | AMACOM | 2011 |

**e-Resources:**

1. **https://altametrics.com/en/human-resources-management/fundamentals-of-human-resource-management.html**
2. **https://www.economicsdiscussion.net/human-resource-management/human-resource-planning-definition-importance-objectives-process-prerequisites/31575**
3. **https://www.whatishumanresource.com/training-and-development**
4. **https://www.emerald.com/insight/content/doi/10.1108/00483480210445962/full/html**
5. **https://www.emerald.com/insight/content/doi/10.1108/IJIS-03-2020-0027/full/html**

**Semester: II**

**Course Name: Financial Management**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA22** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **03:0:02** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

- Knowledge of basic concepts of financial management
- Knowledge, cost of capital, capital structure, capital budgeting etc
- Knowledge of Financial Institutions
- Knowledge of Capital markets

**Course objectives:**

1. To familiarize the students with basic concepts of financial management and financial system.
2. To educate the application of Cost of capital and its implications.
3. To teach investment proposals and its decisions
4. To give insights on the importance and significance of working capital in an organization.
5. To teach the capital structure theories and dividend decision theories and its implication

**Module – 1**

**Introduction**
Meaning, nature and scope of finance; financial goal - profit vs. wealth maximization; Investment, Financing and Dividend decisions - Finance functions – organization structure – functions of finance manager in 21st century – Modern role - treasurer and controller. Emerging role of finance managers. Capital Markets.
**8 Hours (RBT L1, L2, L3)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method, PowerPoint Presentation, YouTube videos
**Skill Enrichment Exercise:** Study the organization structure of Nationalized Banks

**Module - 2**

**Sources of Financing**
Meaning and significance of cost of capital: Calculation of cost of debt, preference capital, equity capital and retained earnings; Combined cost of capital (weighted); Cost of equity and CAPM;

**10 Hours (RBT L1, L2, L3, L4)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method, PowerPoint Presentation, YouTube videos
**Skill Enrichment Exercise:** ( Case Study on Cost of Capital)

**Module – 3**

**Investment Decisions**
Capital budgeting process, Investment evaluation techniques–Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rateofreturnProblem).Riskanalysisincapitalbudgeting-CaseStudyonreplacementofcapitalproject.(Numerical problems). Computer lab for calculation of NPV,IRR,PI,Paybackperiod,ARRinMSexcel.

**12 Hours (RBT L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalkandtalkmethod,PowerPointPresentation,YouTubevideos,MS-excel.
**Skill Enrichment Exercise:** Practical orientation on the Project Evaluation (Case Study)

## Module – 4

**Working Capital Management**

Factors influencing working capital requirements-Current asset policy and current asset finance policy-**Determination of operating cycle and cash cycle on Excel**- Estimation of working capital requirements of a firm.(DoesnotincludeCash,Inventory&ReceivablesManagement). Working Capital Cycle for manufacturing Units.
Financial leverage and its impact on EPEvS – Operating leverage – combined leverage – degree of leverages – working capital leverages – practical use of leverages.

**10 Hours(RBT L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method ,PowerPointPresentation,YouTube videos,MS-excel.
**Skill Enrichment Exercise:** Case study on Working Capital Determination and the impact of negative working capital Amazon-negative working capital and profitability

## Module – 5

**Capital structure and dividend decisions**

Capital structure and dividend decisions – Planning the capital structure-Governance of Equity and Debt, Fall in interest rates and perils of Debt funding. Leverages, EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, StablePayout(No dividend theories to be covered).Case Study on EBIT-EPS analysis & Leverages.

**10 Hours (RBT L3, L4, L5, L6 )**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk method,PowerPointPresentation,YouTube videos, Case study discussion, MS-excel.
**Skill Enrichment Exercise: Case study on Dividend Policy,MS-excel.**

**Course Outcomes:**

At the end of the course the student will be able to:
CO1: Apply the basic financial concepts of Financial management for business use
CO2: Analyze the concept of cost of capital for inferential decisions
CO3: Evaluate the investment decisions in changing business environment
CO4: Estimate working capital requirements for business situations.
CO5: Design capital structure and dividend decisions for varied industries

**Assessment Details**

**CIE:**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

1. The question paper will have 8 full questions carrying equal marks.
2. Each full question is for 20 marks.
3. Each full question will have sub question covering all the topics under a Module.
4. The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
5. 60 percent practical and 40 percent theory in the SEE.

**Suggested Learning Resources:**

| **SN** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Financial Management | Khan M. Y.& Jain P. K, | TMH | 7/e, |
| 2 | Financial Management | Prasanna Chandra | TMH | 9/e |
| 3 | Financial Management | PrahladRathod ,BabithaThimmaiah and Harish Babu | HPH | 1/e, 2015 |
| Reference Books | | | | |
| 1 | Financial Management | I M Pandey | Vikas Publishing | 11/e 2012 |
| 2 | Principles of Corporate Finance | Brealey, Myers, Allen &Mohanty | McGraw Hill Education | 11/e 2014 |
| 3 | Corporate Finance | Vishwanath S. R. | Sage Publications | 3/e 2019 |
| | | | | |

**e- Resources:**

1. http://egyankosh.ac.in//handle/123456789/10310
2. https://nptel.ac.in/courses/110/107/110107144/

**Semester: II**

**Course Name: Research Methodology**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA23** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

Students must have the basics of Managerial process, Role of Data & Information in Research, Basics of Statistics or equivalent in order to pursue this course.

**Course objectives:**

1. To teach the fundamentals and importance of research methodology in business.
2. To foster insight on various research designs and techniques as base for business research.
3. To emphasize the basics of sampling methods and the use different sampling techniques.
4. To teach the methods of data collection with measurement & Scaling Techniques
5. To enable students to identify the problem and procedures for data analysis and report writing skills and presentation.

**Module – 1**

**Introduction:** Meaning, types, manager-researcher relationship, process of research-management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Features of good research study, Internet and research. Ethics in Research

**Skill Enrichment Exercise:**

**Conducting Research with teen demographics**

**Purpose:** Purpose of this activity is to help students of Management (MBA – Research methodology) to think about the practical and ethical issues involved in conducting research with teen demographics. **7 hours (RBT L1, L2, L3)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations.

**Module - 2**

**Business Research Design**

Meaning and significance - Types: Exploratory and Conclusive Research Design.

**Exploratory Research**

Meaning, purpose, methods- Literature review process, experience survey, focus groups and comprehensive case methods. Conclusive Research Design - Descriptive Research - Meaning, Types – Cross sectional studies and longitudinal studies.

Experimental Research Design – Meaning and classification of experimental designs- formal and informal, Pre experimental design, Quasi-experimental design, True experimental design, statistical experimental design.

**Skill Enrichment Exercise:**

**Methods for collecting, sampling, recording, storing and analyzing data.**

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| **Purpose:** This activity encourages students to think about the most appropriate methods for collecting, sampling, recording, storing and analyzing data. It asks students, in their groups, to consider examples of different research projects and answer questions about each project. This will raise awareness of the variety of methods that are available. **9 hours(RBT L1, L2, L3, L4)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations, Videos, Case study. |

**Module – 3**

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| Concepts- Types of Sampling - Probability Sampling – simple random sampling, systematic sampling, stratified random sampling, cluster sampling -Non Probability Sampling –convenience sampling- judgmental sampling, snowball sampling- quota sampling - Sample size, Determination of Sample Size, Characteristics of a Good Sample, Errors in sampling.<br>**Skill Enrichment Exercise:**<br>Recognize the types of probability sampling and non probability sampling methods<br>**Purpose:** This activity, with the use of five real-world examples, helps students to recognize the different types of probability sampling and non probability sampling methods that are available, identify possible strengths and weaknesses and think about how these different methods are used in research. **7 hours(RBT L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations, Research based, Case study. |

**Module – 4**

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| **Data Collection**<br>Primary and Secondary data Primary data collection methods - Observations, survey, Interview and Questionnaire, Qualitative Techniques of data collection, Questionnaire design – Meaning - process of designing questionnaire. Secondary data -Sources – advantages and disadvantages.<br>**Measurement And Scaling Techniques**<br>Basic measurement scales-Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale - Likert's Scale, Semantic Differential Scale, Thurstone scale, Multi-Dimensional Scaling.<br>**Skill Enrichment Exercise:**<br>**Identifying differences between primary and secondary sources**<br>**Purpose:** This activity helps students to understand the differences between primary and secondary sources when they are searching for, and using, information for their course and/or their research.<br>**Designing questionnaire**<br>**Purpose:** This is a practical activity that helps students to design a questionnaire for their research project. It enables them to avoid common mistakes and problems with questionnaire design through providing practical tips, advice, discussion and feedback as their questionnaire is designed, developed and modified. **9 hours (RBT L3, L4, L5, L6 )** |

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| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk, Classroom Lecturers, Seminars and tutorials, Discussions, Power point presentations, videos, Case study. |

**Module – 5**

Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation- Report writing and presentation of results: Importance of report writing, types of research report, report structure, guidelines for effective documentation.
Presentation of Statistics. Oral presentation: Aristotle's 3 Principles of Persuasive Communication. Audience analysis. Organize, Support, visualize Deliver Practice & Arrange. Research analysis by the application of SPSS software.

**Skill Enrichment Exercise:**
**Drawing Conclusions from Qualitative Data**

**Purpose:** This activity asks students to think about and produce a description of the process or procedure that they intend to use to draw conclusions from their qualitative data, and present their description to fellow students for peer feedback and discussion
Each student will be given a copy of the student handout. This asks them to produce a description of the process or procedure that they intend to use to draw conclusions from their qualitative data, which they must present to fellow students. **9hours (RBT L3, L4, L5, L6 )**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk, Classroom Lecturers, Seminars and Tutorials, Discussions, Power point presentations, Case study.

**Course Outcomes:**
At the end of the course the student will be able to:

CO 1: Ability to apply the methods and research techniques to business and management issues.
CO 2: Analyze the appropriate research design, techniques and strategies in the research process.
CO 3: To Evaluate the different methods of sampling of empirical information for better inferences.
CO 4: To Design various research data collection methods by measurement & scaling techniques for quantitative data analysis.
CO 5: To communicate the effective reporting of the business to aid in managerial decisions.

## Assessment Details

**CIE :**

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full questions from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Business Research Methods | Zikmund, Babin, Carr, Adhikari and Griffin | Cengage Learning | 8th Edition, 2016 |
| 2 | Research Methodology, Concepts and Cases, | Deepak Chawla and NeenaSondhi | Vikas publishing house pvt.ltd. | 2nd Edition, 2016. |
| 3 | Research Methodology, | C R Kothari | New Age International, | 4th Edition, 2019. |
| 4 | Marketing Research: Text and Cases, | RajendraNargund kar | Mcgraw Hill Education, | 4th Edition, 2019. |
| Reference Books | | | | |
| 1 | Research Methods | William M C, Trochim | Biztantra | 2nd Edition, 2004 |
| 2 | Methodology Of Research In Social Sciences | MRanganatham, O R Krishnaswamy | Himalaya Publishers | 3rd Edition, 2016 |
| 3 | Research Methodology | Panneerselvam R | PHI Learning, | 2nd Edition, 2014. |
| 4 | Statistical Methods for Practice and Research A guide to data Analysis using SPSS | Ajai S. Gaur and SanjayaS.Gaur | Response Books | 2nd Edition, 2009 |
| | | | | |

**E-Resources:**

1. **https://onlinecourses.nptel.ac.in/noc22_ge08/preview**
2. **https://nptel.ac.in/courses/121/106/121106007/**
3. **https://www.youtube.com/watch?v=XEMyDu_VoeQ**
4. **https://www.emeraldinsight.com/**
5. **https://www.proquest.com/165290**
6. **https://www.bitm.knimbus.com**

**Semester: II**

**Course Name: COMPUTER APPLICATION IN MANAGEMENT**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA24** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **4** | **Exam Hours** | **03** |

**Pre-requisites:**Familiar with the MS word, Basic knowledge with MS Excel, Basic logical and analytical knowledge, basic mathematic knowledge.

**Course Objectives**

1. To contemplate the Computer Concepts and applicable in field of Management.
2. To Analyze the excel functions as a tool for decision making in business situations.
3. To Evaluate data by use of MS Access for managerial decision making
4. To share Insights the concept of e-commerce using web technologies
5. To explain the concept of IOT and Business Analytics

**Module – 1**

**Introduction to Computer:**Introduction, Information and Data, Importance of Hardware and software, CPU, Primary and Secondary storage, I/O devices, Bus structure, Computer Peripherals-VDU, Keyboard, Mouse, Printer. Software and Types of Software, Operation system and types, Programming Languages-, High Level Language. **9 Hours (RBT Levels:L1, L2, L3)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk, Power point presentation, Group discussion, videos clippings, Demonstration of Hardware component of computer.

**Skill Enhancement Activities:** Lab session Demonstrations and Videos clippings, Presentation of Hard ware components

**Module - 2**

**Introduction to Excel**:Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving from selected cells, basic statement; SUM, AUTOSUM, SUMPRODUCT, AVG, IF, COUNTIF.

**Formatting a Worksheet:** Formatting Cells – changing data alignment, changing date, number, character or currency format, changing font, adding borders and colors, Printing worksheets, Charts and Graphs – Creating, Previewing, Modifying Charts.

**Functions:** Mathematical, Logical, statistical, text, financial, Date and Time functions, Using Function Wizard.**10Hours (RBT Levels L1, L2, L3, L4)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk and talk, Group discussion, Case Study, Power point presentation, videos clippings, Exercises conducted in computer lab

**Skill Enhancement Activities:** Lab session of excel function and formula, Solving practical business Problems.

**Module – 3**

**Introduction to DBMS:**Database Management System & Applications Overview of Database Management – File oriented approach versus database oriented approach to data management, Disadvantage of file oriented approach

MS-Access: Introduction, creation of database and table, inserting values in a table, Sorting, deletion, Merging of rows, Linking on table and another, Report generation, Embedding MS excel in Access.**11 Hours (RBT Levels: L2, L3, L4, L5)**

| **Teaching-Learning Process:** |
|---|
| **Pedagogy:** Chalk and talk, Group discussion, Case Study, Power point presentation, Exercises conducted in computer lab, videos clippings<br>**Skill Enhancement Activities:** Lab session of MS Access Solving practical business Problems. |

**Module – 4**

| **Introduction to Internet and Web Technologies:** Definition, application, threats, working of Internet, Web Technology: Introduction, Types of servers, cryptocurrency conceptse-Commerce: Structure of e-commerce, Types of e-Commerce, analytics of e-commerce,ethics of E-commerce<br>**10 Hours (RBT Levels:L2, L3, L4, L5)** |
|---|
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk, Group discussion, Case Study, Power point presentation, videos clippings<br>**Skill Enhancement Activities:** Basics Theoretical exercise on e-commerce and its application |

**Module – 5**

| **Introduction to IOT and Business Analytics :** Overview of IOT; meaning of IOT; History of IOT; Advantages of IOT; Challenges of IOT; IOT working process; Architecture of IOT; Devices and network; Applications of IOT at Smart home.<br>Overview for Data Science; Definition of data and information; Data types and representation; Data Value Chain; Data Acquisition; Data Analysis; Data Curating; Data Storage; Data Usage; Basic concepts of Big Data.**10Hours (RBT Levels: L3, L4, L5, L6)** |
|---|
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and talk, Group discussion, Case Study, Power point presentation, videos clippings<br>**Skill Enhancement Activities:** Basics Theoretical exercise on IOT its application |

| **Course outcomes:**<br>At the end of the course the student will be able to:<br>CO1: To apply the basis of computer application for visualization of data to aid decisions<br>CO2: To analysis and interpret the data for interpretation business situation<br>CO3: To evaluate the different business scenarios with the DBMS Concept<br>CO4: To Demonstrate the data structuring and constructing the business Models<br>CO5: To Comprehend the latest developments in the area of technology to support business |
|---|

**Assessment Details**

**CIE :**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be

proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full questions from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things | Follett, J. | O'Reilly Media | 2014 |
| 2 | Emerging Technologies for Emerging Markets | Vong, J., & Song, I. | Springer Singapore | 2014 |
| 3 | Teach Yourself Excel | Matthew Harris | SAM | 1999 ISB-13: 978-0672315435 |
| 4 | MS Access Programming by Example | JulittaKorol | Wordware Publishing Inc. | 2001 |
| 5 | A Textbook on E-Commerce: Text & Cases | W. K. Sarwade&AnuranjanMisra | A.K. Publications | ISBN-10: 9380164270 |
| **Reference Books** | | | | |
| 1 | Winning in the Digital Age: Seven Building Blocks of a Successful Digital Transformation . | by Nitin Seth | Penguin Enterprise | 24 February 2021 |
| 2 | Computer Applications in Management | PuneetSaneja Charu Chawla | Hindustan Publishing Corporation ISBN: 9788124116937, 9788124116937 | 2019 |

**e-Resources:**

1. https://www.ddegjust.ac.in/studymaterial/mba/cp-106.pdf
2. https://lumenlearning.com/courses/computer-applications-for-managers/
3. https://www.encyclopedia.com/computing/news-wires-white-papers-and-books/library-applications

**Semester: II**

**Course Name: Strategic Management**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA25** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:** Students should have basic knowledge of

- Management and Organizational Behaviour Principles
- Basic economic terminologies and concepts.
- Basic Finance fundamentals.
- Logical Reasoning

**Course objectives:**

1. To provide insights on applications of core concepts and models of strategic management.
2. To emphasize various business models in dynamic market environments.
3. To infer insights about various strategic management models used in different business phases.
4. To educate the importance of overview of business and formulating and implementation of strategies.
5. To teach the importance of strategic controlling measures for better decision making.

## Module – 1

**Introduction:** Meaning and Nature of Strategic Management, its Importance and Relevance and. Characteristics of Strategic Management, The Strategic Management Process. Relationship Between a Company's Strategy and its Business Model.
**Skill Enrichment Exercise:** Study of strategic overview of companies across industries.
**Strategy Formulation:** Developing Strategic Vision and Mission for a company – Setting Objectives – Strategic Objectives and Financial Objectives – Goals, Long Term Objectives, Short-Term Objectives, Strategic group mapping, Strategic Intent, Strategic Fit, Gap Analysis, Balanced Scorecard

**10 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:** Applications of balanced scorecard in an organization.

## Module - 2

**Analyzing Companies External Environment:**

**External Analysis:** StrategicallyRelevantComponentsofaCompany'sExternalEnvironment–IndustryAnalysis-FactorsDrivingIndustry Change and its Impact - Porter's Dominant Economic Feature - Competitive Environment Analysis - Porter's Five Forces Model– Key Success Factors Concept and Implementation.

**10 Hours (RBT Levels: L1, L2, L3, L4)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:** Assignments for Assessing the critical success factors by appropriate models.

## Module – 3

**Analyzing Companies Internal Environment:**
**Internal Analysis: Analyzing a company's resources and competitive position –** Analysis of a Company's present strategies - SWOT Analysis – Resource Based View of the firm (RBV) - Value Chain Analysis – Benchmarking, Generic Competitive Strategic – Low cost provider Strategy - Differentiation Strategy - Best cost provider Strategy – Focused Strategy – Growth strategies & retrenchment strategies - Strategic Alliance and Collaborative Partnerships – Mergers and Acquisition Strategic - Outsourcing Strategic - International Business level.

**10 Hours (RBT Levels: L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:** SWOT analysis on various organizations with strategic intent.

## Module – 4

**Business planning in different environment:**
Business planning in different environment - Entrepreneurial level Business planning – Multistage wealth creation model for entrepreneurs – Planning for large and diversified companies – brief overview of Innovation, integration, Diversification, Turnaround Strategic – GE nine cell planning gird – BCG matrix.

**10 Hours (RBT Levels: L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:** Contemplating various strategic models across industries.

## Module – 5

**Strategic Implementation & Control:**
Organizational design, structures, culture, Importance of integrating strategy implementation and strategy formulation. Organizational structures used to implement different business level strategies and corporate level strategy. Strategic control, Types, Role of Corporate Governance.

**10 Hours (RBT Levels: L3, L4, L5, L6)**

**Teaching-Learning Process:**

**Pedagogy:** Chalk & Talk Method, Group discussion, Seminar, Power point presentation, Case Study &Experiential exercises.
**Skill Enrichment Exercises:** Case studies on Corporate governance practices of varied organizations.

**Course Outcomes:**
At the end of the course the student will be able to:
CO1: Apply concepts and models of strategic management.
CO2: Analysis the business environment to formulating appropriate strategy for business development.
CO3: Evaluate the competitive situation using strategic models in dealing with business environment.
CO4: Develop the driving strategies for the holistic business challenges in varied industries.
CO5: Design strategic performance using controlling measures for business situations.

## Assessment Details

**CIE :**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

**The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.**

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Crafting and Executing Strategy:The Quest for CompetitiveAdvantage–ConceptsandCases | ArthurA.ThompsonJr.Margaret A. PeterafJohnE. Gamble A.J.StricklandIIIArunK. Jain | McGraw HillEducation | 19/e 2017 |
| 2 | StrategicManagement: ASouth-AsianPerspective | MichaelA.Hitt R. Duane IrelandRobertE.Hoskisson S.Manikutty | CengageLearning | 9/e 2016 |
| Reference Books | | | | |
| 1 | Strategy: Theory&Practice | StewartCleggChris CarterMarting KornbergerJochenSchweitzer | SagePublications | 3/e,2020 |
| 2 | Strategy Management:Theory&Practice | JohnParnell | Biztantra | 2004 |
| 3 | StrategicManagement: Planning for Domestic and GlobalCompetition | John A. PearceRichardB.Robinson | McGraw HillEducation | 14/e 2015 |
| | | | | |

**e-Resources:**

https://youtu.be/ZG3_8fG7RzQ[BBC Documentary ]-Worlds Most Powerful- - Bill Gates Vs Steve Jobs
https://youtu.be/0FoTFal0KAA - BBC Documentary_ Steve Jobs - Billion Dollar Hippy
https://youtu.be/5WiDIhIkPoM - Mark Zukerberg_ Inside Facebook (BBC)
https://youtu.be/y5I_cnpP99U - Michael Porter on Competitiveness
https://youtu.be/xcZG5sIqSHE
https://www.classcentral.com/course/swayam-strategic-management-14306
https://onlinecourses.swayam2.ac.in/imb20_mg33/preview
https://swayam.gov.in/nc_details/IIMB
https://nptel.ac.in/courses/110/108/110108047/

**Semester: II**

**Course Name: ENTREPRENEURSHIP & LEGAL ASPECTS**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA26** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **3:0:2** | **SEE Marks** | **50** |
| **Credits** | **04** | **Exam Hours** | **03** |

**Pre-requisites:**

- Basic Fundamentals of Marketing, HR, Finance & Accounting skills inclination to innovation
- Good communication & presentation skills
- Inquisitiveness for entrepreneurship
- Knowledge about business environment

**Course objectives:**

1. To educate the nature, characteristics and importance of entrepreneur.
2. To impart planning insights and preparation feasibility business reports.
3. To provide an overview of entrepreneurship opportunities, sources of funding and institutions supporting entrepreneurs.
4. To familiarize the concept family business performance, and strategies for its development.
5. To emphasize the various rules and legislations related to various acts for entrepreneurial development.

**Module – 1**

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| **Entrepreneur & Entrepreneurship:** Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Classification of Entrepreneur – Role of an Entrepreneur-Intrapreneur- an emerging class – Concept - Entrepreneur Vs Intrapreneur Vs Manager - Evolution and Development of Entrepreneurship - Entrepreneurial mindset and process. **Creativity and Innovation:** The role of creativity- The innovation Process -Sources & Methods of Generating New Ideas & Creative Problem Solving. **(10 hours) (RBT Levels: L1, L2, L3)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk method, Group Discussion, Case Study, Power Point Presentation, Video clipping **Skill Enrichment Exercises:** Students should submit a profile summary of a successful local entrepreneur indicating milestone achievements. |

**Module - 2**

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| **Business Planning Process:** Importance of Business Model- Components of an Effective Business Model, Osterwalder Business Model Canvas. Meaning of business plan - Business plan process - Advantages of business planning – Why do Business plans fail - Marketing plan - Production/operations plan - Organization plan – Financial plan - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture. **(10 hours) (RBT Levels: L1, L2, L3, L4)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation **Skill Enrichment Exercises:** Students should develop a business model for a new product/service including feasibility report. |

**Module – 3**

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| **Entrepreneurial finance:** Estimating the financial needs of a new venture, internal & external sources of finance **Informal Risk Capital and Venture Capital:** Informal risk capital market - venture capital – nature, overview and process – professionals involved in venture capital – venture capital industry in India.<br>**Institutions supporting Entrepreneurs:** Small industry financing developing countries – A brief overview of financial institutions in India - Central level and state level institutions – SIDBI- NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - DIC – Single Window - Latest Industrial Policy of Government of India.<br>**(10 hours) (RBT Levels: L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation, Video clipping<br>**Skill Enrichment Exercises:** Students should visit a bank/financial institution to enquire about various funding schemes for small scale enterprise. Student engagement in Karnataka Udyog web sites https://www.india.gov.in/karnataka-udyog-mitra-portal |

**Module – 4**

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| **Family Business:** Importance of family business – Types- Various Forms of business organization - History - Responsibilities and rights of shareholders of a family business – 3-circle model of family business -Succession in family business - Pitfalls of the family business - strategies for improving the capability of family business - improving family business performance. Success stories of entrepreneurial knowledge exercises.<br>**Startup Business**: Startup Process, and its feasibility<br>**(10 hours) (RBT Levels: L2, L3, L4, L5 )** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation, Video clipping<br>**Skill Enrichment Exercises**: Students should analyze the performance of listed family firms and should submit a short report by studying the ideology and working of partnership firm, cooperative society, private and public company. Case study related to performance of family business. |

**Module – 5**

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| Applicability of Legislation; Industries Development (Regulations) Act, 1951; Factories Act, 1948; Industrial Employment (Standing Orders) Act, 1946, Suspension, Stoppage of work, Termination of employment; Karnataka Shops and Establishment Act, 1961; Environment (Protection) Act, 1986; The sale of Goods Act; 1930; Industrial Dispute Act 1947.<br>**(10 hours) (RBT Levels: L3, L4, L5, L6 )** |
| **Teaching-Learning Process:** |
| **Pedagogy:** Chalk and Talk Method, Group Discussion, Case Study, Power Point Presentation, Video clipping<br>**Skill Enrichment Exercises:** Students should submit report by assessing the applicability of various acts by selecting different companies. Case study related to Factories Act 1948. |

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| **Course Outcomes:**<br>CO1: Apply the concept of entrepreneurship to various business plans.<br>CO2: Analyze the feasibility of different stages in business planning process. |

CO3: Evaluate the various sources of funding to support entrepreneurship.
CO4: Develop the key elements of entrepreneurship in relation to family business organizations.
CO5: Comprehend the various rules, legislations and their applicability in entrepreneurial development.

## Assessment Details

**CIE :**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| **(i)** | Tests (A) | 3* | 60% | 30 |
| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:**

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks.
- Each full question will have sub question covering all the topics under a Module.
- The students will have to answer five full questions, selecting four full question from question number one to seven and question number eight is compulsory.
- 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | The Dynamics of Entrepreneurial Development and Management | Vasant Desai | Himalaya Publishing House | 6th Edition 2019 |
| 2 | Entrepreneurship Development-Small Business Enterprises | Poornima Charantimath | Pearson Education | 3rd Edition 2015 |
| 3 | Entrepreneurship | Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd | McGrawHill | 6th Edition 2008 |
| Reference Books | | | | |
| 1 | Entrepreneurial Development | Dr. S. S. Khanka | S. Chand Publishing House | Revised Edition - 2007 |
| 2 | Entrepreneurship | Rajeev Roy | Oxford University Press | 3rd Edition. |
| | | | | |

**e-Resources:**

1. https://www.youtube.com/watch?v=Bf_nEWxSSkQ
2. https://www.youtube.com/watch?v=sOjeQV5pHh4
3. https://www.youtube.com/watch?v=Fqch5OrUPvA
4. https://www.youtube.com/watch?v=sC236knTsYw
5. https://www.youtube.com/watch?v=YlQFRzW6USQ

**Semester: II**

**Course Name: BUSINESS ETHICS AND HUMAN VALUES**

| | | | |
|---|---|---|---|
| **Course Code** | **22MBA27** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **2:0:0** | **SEE Marks** | **50** |
| **Credits** | **02** | **Exam Hours** | **03** |

**Pre-requisites:**Familiar with the basic management concepts and human Relation and Finance concepts, familiar with basics concepts of corporate social responsibility (CSR).

**Course objectives:**

1. To familiarize the business Ethics and to provide best practices of business situation.
2. To learn the values and ethical issues in corporate governance and to adhere to the ethical codes.
3. To teach the work ethos and values required for good managers and ethical careers.
4. To educate the significance of stress management and mechanism to handle employee stress.
5. To give insights on the contemporary Indian ethos in work environment.

**Module – 1**

**Introduction:** Values-Concept, types and formation of values, ethics, values and behaviour, Values of Indian Managers, Ethics, development of ethics, ethical decision making and decision making process, relevance of ethics and values in business.

**8 Hours (RBT Levels: L1, L2, L3)**

**Teaching-Learning Process:**

**Pedagogy:**Chalk & Talk method, Group discussion, Case study, Power point presentation, Video Clippings, Quiz

**Skill Enrichment Exercise**: Learn the principal of ethic by corporate example

**Module - 2**

**Corporate Social Responsibility & Consumer Protection:**

Corporate Social Responsibility & Consumer Protection: Corporate responsibility of business: employees, consumers and community, Corporate Governance, Code of Corporate Governance, Consumerism, unethical issues, in sales, marketing and technology.

**10Hours (RBT Levels: L1, L2, L3, L4)**

**Teaching-Learning Process:**

**Pedagogy:**Chalk & Talk method, Group discussion, Case study, Power point presentation, Video Clippings, Quiz

**Skill Enrichment Exercise:** Collect the Data of various companies involved in CSR activities.

**Module – 3**

**Work Ethos and Values: Work Ethos:** Meaning, Levels, Dimensions, Steps, Factors Responsible for Poor Work Ethos. Values: Meaning, Features, Values for Indian Managers, Relevance of Value Based Management in Global Change, Impact of Values on Stakeholders: Employees, Customers, Government, Competitors and Society. Relevance of values in management: need for values in global change- Indian perspective; values for managers; holistic approach for managers in decision making; secular versus spiritual values in management, Trans-Cultural Human Values in Management and Management Education, Importance of Value System in Work Culture, teaching ethics,Concept of Value Champions**.**

**12 Hours (RBT Levels: L2, L3, L4, L5)**

**Teaching-Learning Process:**

**Pedagogy:**Chalk & Talk method, Group discussion, Case study, Power point presentation, Video Clippings, Quiz.

**Skill Enrichment Exercise:** Case Study on Work Ethos and Values.

## Module – 4

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| **Stress Management:** Meaning, Types of Stress at Work, Causes of Stress, Consequences of Stress, Problems relating to stress in corporate management –Indian perspective, Stress Management Techniques: Meditation-Meaning, Techniques, Advantages, Mental Health and its Importance in Management, Brain Storming, Brain Stilling, Yoga: Meaning, Significance. **10 Hours (RBT Levels: L2, L3, L4, L5)** |
| **Teaching-Learning Process:** |
| **Pedagogy:**Chalk & Talk method, Group discussion, Case study, Power point presentation, Debate,Quiz<br>**Skill Enrichment Exercise:** Role plays on handling stress Management. |

## Module – 5

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| **Leadership:** Meaning, Contemporary Approaches to Leadership, Joint Hindu FamilyBusiness–LeadershipQualitiesofKarta;Motivation:Meaning,IndianApproachto Motivation,Techniques.Self-Management:PersonalgrowthandLessonsfromAncient Indian Education System, Personality Development: Meaning, Determinants,Indian Ethos and Personality Development, science and human values. Trans-cultural human values in management education.<br>**10 Hours (RBT Levels: L3, L4, L5, L6)** |
| **Teaching-Learning Process:** |
| **Pedagogy:**Black Board Teaching, Group discussion, Case study, Power point presentation, Debate,Quiz<br>**Skill Enrichment Exercise:** Role Plays of various leadership styles. |

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| **Course Outcomes:**<br>CO1: Illustrate and apply the theoretical foundations of business ethics.<br>CO2: Analyze the knowledge of corporate governance and business concepts from an ethical perspective.<br>CO3: Evaluate the importance of Work Ethos and Values of business with community and ethical conduct.<br>CO4: Develop proactive steps to stressful business situations and resolve ethical.<br>CO5: Communicate and reflect by critically examine the values and importance of the ethical dimension in business and workplace decision making. |

## Assessment Details

**CIE :**

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
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| **(ii)** | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

**SEE:** The SEE question paper will be set for 100 marks and the marks scored will be

proportionately reduced to 50.

1. The question paper will have 8 full questions carrying equal marks.
2. Each full question is for 20 marks.
3. Each full question will have sub question covering all the topics under a Module.
4. The students will have to answer five full questions; selecting four full question from question number one to seven and question number eight is compulsory.
5. 100 percent theory in the SEE.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Foundation of Managerial Work-Contributions from Indian Thought | Chakraborty, S.K | Himalaya Publication House, Delhi | 1998 |
| 2 | Ethics In Management and Indian Ethos | Biswanath Ghosh | Vikas Publishing House | 2009 |
| 3 | Indian Ethos and Values for Managers | Khandelwal | Himalaya Publication House, Delhi | 2009 |
| Reference Books | | | | |
| 1 | Indian Ethics and Values in Management | R Nandagopal, AjithSankar R. N. | Tata Mc Graw Hill | 2009 |
| 2 | Management by Values | S. K. Chakraborty | Oxford University Press, New Delhi | 2009 |
| 3 | Ethics and the Conduct of Business | by R Boatright John D Smith Jeffrey PrasanPatra Bibhu | Pearson Education | Oct 2017 |

**e-Resources:**

1. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf
2. https://www.researchgate.net/publication/226607374_Business_Ethics_Resources_on_the_Internet
3. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf

# 1st Semester Syllabus

**Semester: I**

Course Name: **MATHEMATICAL FOUNDATION FOR COMPUTER APPLICATIONS**

| | | | |
|---|---|---|---|
| Course Code | 23MCA11 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Sets, Relations and Functions:** Basics of set theory, Cartesian product of sets. Relations, Properties of relations, Zero-one matrices and directed graphs, Hasse diagram, Equivalence relations and partitions. Functions- types of functions: composition function and Inverse function. Permutation of functions

**Module – 2**

**Logic:** Propositions-Truth Value, Conjunction, Disjunction, Negation, Implication, Converse, Inverse, Contrapositive, Biconditional, Order of Precedence, Tautology, Contradiction,
Logical Equivalences, Quantifiers: Predicates, De Morgan's Laws, Arguments: Valid and Invalid Arguments, rules of inference

**Module – 3**

**Statistical Methods:** Measures of Central Tendency (Mean, Median, Mode, Other averages), Measures of Dispersion (range, mean deviation, standard deviation), Curve fitting by method of least squares. Fit curves of the forms $y=ax+b$, $y=ax^2+bx+c$ and $y=ax^b$ . Correlation and regression analysis

**Module – 4**

**Probability Distributions:** Random variables- discrete and continuous, probability mass function, probability density function, Cumulative density function. Binomial distribution, Poisson distribution, Exponential distribution and Normal distribution. (only examples)

**Module – 5**

**Graph Theory:** Graphs and Graphs models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Planar Graphs, Graph Coloring.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Discrete Mathematics and its Applications | Kenneth H Rosen | McGraw Hill publications | 7th Edition |
| 2 | Probability and Statistics for engineers and Scientist | Wolpole Myers Ye | Pearson Education | 8th edition |
| 3 | Graph Theory: With Application to Engineering and Computer Science | NarsinghDeo | Prentice Hall of India | 16th Edition 2003 |
| **Reference Books** | | | | |
| 1 | Probability and statistics for engineers | Richard A Johnson and C.B Gupta | Pearson Education | |
| 2 | Discrete Mathematics | J.K Sharma | Mac Millian Publishers India | 3rd Edition 2011 |

**Semester: I**

Course Name: **OPERATING SYSTEM with UNIX**

| | | | |
|---|---|---|---|
| Course Code | 23MC12 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40+20 | Total Marks | 100 |
| Credits | 4 | Exam Hours | 03 |

**Module – 1**

**File System:** The File, What's in a File name, The Parent-Child Relationship, The HOME Variable: The Home Directory, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The Unix File System. The vi Editor: vi Basics, Input Mode, ex Mode and Command Mode.
**Basic File Attributes:** ls options, File Ownership, File Permissions, chmod, Directory Permissions, Hard link and soft link

**8 Hours**

**Module – 2**

**The Shell:** The Shell's Interpretive Cycle, Shell Offerings, Pattern Matching-The Wild-cards, Escaping and Quoting
**Redirection:** The Three Standard Files, grep command
**Two Special Files:** /dev/null and /dev/tty, pipes, tee, Command Substitution
**The Process:** Process Basics, ps: Process Status, System Processes, Mechanism of Process Creation, Internal and External Commands, Running Jobs in Background, Killing Processes with Signals, Job Control, at and batch, cron

**8 Hours**

**Module – 3**

**Introduction to operating systems, System structures:** Operating systems functionalities, Computer system organization, Computer system architecture, Operating system structure, Operating system operations, Process management, Memory management, Storage management; Protection and Security, Distributed system, Special-purpose systems.
**Operating System Services**: User - Operating system interface, System calls, Types of system calls, System programs, Operating system design and implementation, Virtual machines, System boot.

**8 Hours**

**Module - 4**

**Process Management:** Process concept, Process scheduling, Operations on processes, Inter process communication.
**Process Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, thread scheduling.

**8 Hours**

**Module – 5**

**Deadlocks:** System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

**Memory Management:** Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.

**8 Hours**

**PRACTICAL COMPONENT 20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Write a shell script that accepts a path name and creates all the components in that path name as directories. For example, if the script is named as mpc, then the command mpc a/b/c/d should create sub-directories a, a/b, a/b/c, a/b/c/d. |
| 2 | Write a shell script that accepts two filenames as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permissions otherwise output each filename followed by its permissions |
| 3 | Install an operating system on a physical or logical (virtual) machine. |
| 4 | Design, develop and implement program to simulate the working of Shortest Remaining Time First scheduling algorithm. Experiment with different length jobs. |
| 5 | Design, develop and implement program to simulate the working of Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm. |
| 6 | Design, develop and implement a Banker's algorithm. Assume suitable input required to demonstrate the results. |
| 7 | Write a shell script that takes a valid directory name as a argument recursively descend all the sub-directors, find the maximum length of any file in that hierarchy and writ the maximum value to the standard output |

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Operating Systems Principles | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne | Wiley – India | 8th Edition |
| 2 | UNIX Concepts and Applications | Sumitabha Das | Tata McGraw Hill | 4th Edition, 2006 |
| **Reference Books** | | | | |
| 1 | An Introduction to Operating Systems: Concepts and Practice | P.C.P. Bhatt | PHI(EEE) | 4th Edition, 2014 |

**Semester: I**

Course Name: **DATA STRUCTURES AND APPLICATIONS**

| | | | |
|---|---|---|---|
| Course Code | 23MCA13 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction to Data Structures**: Basic concepts, classification of data structures, operations on data structures.
**Searching techniques:** Linear search and Binary search.
**Sorting techniques:** Bubble sort, selection sort, pointer declaration and initialization, pointer and function (pass by address method), DMA, Recursion.

**8 Hours**

**Module - 2**

**Linear Data Structures**
**Stacks:** Primitive operations and its implementation of stacks using Arrays, applications of stacks, arithmetic expression conversion and evaluation.
**Queues**: Primitive operation and Implementation of Ordinary Queue using Arrays, applications of linear queue, Circular queue, Priority Queue, Sparse Matrix Representation in Triplet Format.

**8 Hours**

**Module – 3**

**Linked Lists:** Introduction, representation of a linked list in memory, Types of linked lists and implementation: Single linked lists, Circular linked lists, doubly linked lists, operations on a single linked list.
**Applications of linked lists:** Polynomial representation and sparse matrix representation using linked list.

**8 Hours**

**Module – 4**

**Non-Linear Data Structures**
**Trees**: Basic concept, binary tree, properties of binary tree, binary tree representation, binary tree traversal, Binary search trees, application of trees.
**Graphs**: Basic concept, graph terminology, graph implementation, graph traversals: DFS, BFS, Application of graphs.

**8 Hours**

**Module – 5**

**Fundamentals of the Analysis of Algorithm Efficiency:** Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Brute force Approach.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Data Structures in C | Ellis Horowitz and Sartaj Sahni | Universities Press | 2nd Ed, 2014 |
| 2 | Data Structures using C | Reema Thareja | Oxford press | 3rd Ed, 2012 |
| 3 | Introduction to the Design and Analysis of Algorithms | Anany Levitin | Pearson | 2nd Ed, 2009 |
| **Reference Books** | | | | |
| 1 | Data Structures: A Pseudo-code approach with C | Gilberg and Forouzan | Cengage Learning | 2nd Ed, 2014 |

**Semester: I**

Course Name: **SOFTWARE ENGINEERING & PROJECT MANAGEMENT**

| | | | |
|---|---|---|---|
| Course Code | 23MCA14 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction to Software Engineering:** Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics.
**Software Process Models:** Waterfall Model, Incremental Model and Spiral Model, Rational Unified Process (RUP).
**Requirements Engineering Process:** Requirements Elicitation and Analysis, Functional and Non-Functional Requirements, Software Requirements Document, Requirements Specification, Requirements Validation, Requirements Management.

**8 Hours**

**Module - 2**

**System Model:** Context Models, Interaction Models, Structural Models, Behavioral Models. **Object-oriented design:** OO Themes, **The Three Models:** Class Modelling, Object and Class, Link and associations, Generalization and Inheritance, Object Oriented Design Process, Use Case, Sequence and State Diagrams.

**8 Hours**

**Module – 3**

**Software Testing and Maintenance:** Development Testing, Test-Driven Development, Release Testing, User Testing, Test Automation. **Evolution Process:** Program Evolution Dynamics, Software Maintenance, Legacy System Management.

**8 Hours**

**Module – 4**

**Project Planning:** Software Pricing, Project Scheduling, Estimation Techniques, Software Standards, Software Quality, Reviews and Inspections, Software Measurement and Metrics

**8 Hours**

**Module – 5**

**Case Studies:** Real-life examples such as Patient Health Care System, Weather Station, Microwave Oven, Washing Machine etc.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Software Engineering | Ian Sommerville | Pearson Education Ltd | 9th Edition 2001 |
| 2 | Software Engineering | Pankaj Jalote | Wiley India Pvt Ltd | 2010 |
| 3 | Object-Oriented Modelling and Design with UML | MichelBlaha, James Rumbaugh | Pearson | 2nd edition 2007 |
| **Reference Books** | | | | |
| 1 | Object oriented software engineering | Stephan R. Schach | Tata McGrawHil | 2008 |
| 2 | Applying UML and Patterns | Craig Larman | Pearson Education | 2005 |

**Semester: I**

Course Name: **WEB TECHNOLOGIES**

| | | | |
|---|---|---|---|
| Course Code | 23MCA15 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction to Web:** Internet, www, web browsers and web servers, URLs, MIME, HTTP, **Introduction to HTML:** Basic structure, HTML formatting tags, adding images to web page, creating lists, tables, linking web pages, making forms, frames

**8 Hours**

**Module - 2**

**Cascading Style sheets(CSS):** Introduction to style sheets, levels of style sheets, style specification formats, Selector forms, property value forms, font properties, background images, colors and properties, borders and boxes, CSS2

**8 Hours**

**Module – 3**

**Introduction to JavaScript:** Need of JavaScript, adding Javascript to HTML programs, variables, expressions, data types, conditional statements, loops, arrays, writing user defined functions, Events and event handling using Javascript, handling mouse events, window events, validating form elements using Javascript, pattern matching using regular expressions, DOM2 event model, the navigator object

**8 Hours**

**Module – 4**

**Introduction to JQuery:** Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS.

**8 Hours**

**Module – 5**

**Introduction to Angular JS:** Directives, Expressions, Directives, Controllers, Filters, Services, Events, Forms, Validations, Examples

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Programming the World Wide Web | Robert W. Sebesta | Pearson Education | 4th Edition 2008 |
| 2 | Web Technologies | Black Book | Dreamtech Press | 2018 |
| 2 | Web Programming | Chris Bates | Wiley Publications | |
| 3 | Angular JS | Krishna Rungta | | 2018 |
| **Reference Books** | | | | |
| 1 | Internet and World Wide Web How to program | P.J. Deitel & H.M. Deitel | Pearson | 4th Edition, 2012 |

**Semester: I**

Course Name: **DATA STRUCTURES LAB**

| | | | |
|---|---|---|---|
| Course Code | 23MCAL16 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:4 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 2 | Exam Hours | 03 |

## List of Experiments:

**Program 1:** Design, Develop and Implement a menu driven Program in C for the following **Array** operations
a. Creating an Array of **N** Integer Elements
b. Display of Array Elements with Suitable Headings
c. Searching an Element using Binary Search
d. Sorting an Array elements using Bubble Sort Technique
e. Exit
Support the program with functions for each of the above operations.

**Program 2:** Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
a. ***Push*** an Element on to Stack
b. ***Pop*** an Element from Stack
*c.* Demonstrate how Stack can be used to check ***Palindrome***
d. Demonstrate ***Overflow*** and ***Underflow*** situations on Stack
e. Display the status of Stack
f. Exit
Support the program with appropriate functions for each of the above operations

**Program 3:** Design, Develop and Implement a Program in C Language for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands

**Program 4:** Design, Develop and Implement a menu driven Program in C Language for the following operations on QUEUE of Integers (Array Implementation of Queue with maximum size MAX)
a. Insert an Element on to QUEUE
b. Delete an Element from QUEUE
c. Demonstrate Overflow and Underflow situations on QUEUE
d. Display the status of QUEUE
e. Exit
Support the program with appropriate functions for each of the above operations

**Program 5:** Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: ***USN, Name, Branch, Sem, PhNo***
a. Create a **SLL** of **N** Students Data by using ***front insertion***.
b. Display the status of **SLL** and count the number of nodes in it
c. Perform Insertion / Deletion at End of **SLL**
d. Perform Insertion / Deletion at Front of **SLL(Demonstration of stack)**
e. Exit

| |
|---|
| **Program 6:** Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: ***SSN, Name, Dept, Designation, Sal, PhNo***<br>a. Create a **DLL** of **N** Employees Data by using ***end insertion***.<br>b. Display the status of **DLL** and count the number of nodes in it<br>c. Perform Insertion and Deletion at End of **DLL**<br>d. Perform Insertion and Deletion at Front of **DLL**<br>e. Demonstrate how this **DLL** can be used as **Double Ended Queue**<br>f. Exit |
| **Program 7:** Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers<br>a. Create a BST of **N** Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2<br>b. Traverse the BST in Inorder, Preorder and Post Order<br>c. Search the BST for a given element (**KEY**) and report the appropriate message<br>d. Exit |
| **Program 8:** Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers<br>a. Create a BST of **N** Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2<br>b. Insert a given element (**KEY) into** Binary Search Tree**.**<br>c. Delete an element **(KEY)** from Binary Search Tree<br>d. Exit |
| **Program 9:** Design, Develop and Implement a Program in C for the following operations on **Graph(G)** of Cities<br>a. Create a Graph of **N** cities using Adjacency Matrix.<br>b. Print all the nodes **reachable** from a given starting node in a digraph using DFS/BFS method |
| **Program 10:** Given a set of cities and the distances between each city, find the shortest possible route that visits each city exactly once and return to the starting city using brute force technique (The Traveling Salesman Problem (TSP) problem ). |

**Semester: I**

Course Name: **WEB TECHNOLOGIES LABORATORY**

| | | | |
|---|---|---|---|
| Course Code | 23MCAL17 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:4 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 2 | Exam Hours | 03 |

**List of Experiments:**

**Part - A**

1. Create an XHTML page that provides information about your department. Your XHTML page must use the following tags: a) Text Formatting tags b) Horizontal rule c) Meta element d) Links e) Images f) Tables (Use of additional tags encouraged)

2. Develop and demonstrate the usage of inline, external and internal style sheet using CSS. Use XHTML page that contains at least three paragraphs of text, listed elements and a table with four rows and four columns.

3. Develop and demonstrate a XHTML file that includes Javascript script for the following problems: a) Input : A number n obtained using prompt Output : The first n Fibonacci numbers b) Input : A number n obtained using prompt Output : A table of numbers from 1 to n and their squares using alert

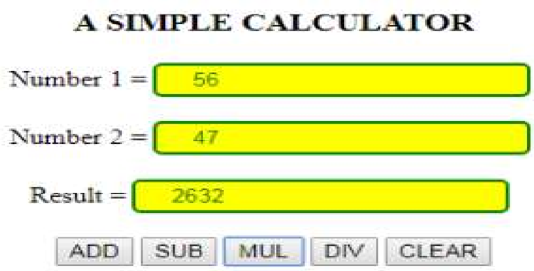
4. Develop, test and validate an XHTML document that has checkboxes for apple (59 cents each), orange (49 cents each), and banana (39 cents each) along with submit button. Each check boxes should have its own onclick event handler. These handlers must add the cost of their fruit to a total cost. An event handler for the submit button must produce an alert window with the message 'your total cost is $xxx', where xxx is the total cost of the chose fruit, including 5 percent sales tax. This handler must return 'false' (to avoid actual submission of the form data). Modify the document to accept quantity for each item using textboxes.

5. a) Develop and demonstrate, a HTML document that collects the USN (the valid format is : A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by three upper-case characters followed by two digits; (no embedded spaces are allowed) from the user. Use JavaScript that validate the content of the document. Suitable messages should be display in the alert if errors are detected in the input data. Use CSS and event handlers to make your document appealing. b) Modify the above program to get the current semester also(restricted to be a number from 1 to 6)

6. Develop and demonstrate a HTML file which includes JavaScript that uses functions for the following problems: a. Parameter: A string Output: The position in the string of the left-most vowel. b. Parameter: A number Output: The number with its digits in the reverse order.

7. Develop and demonstrate a HTML5 page which contains a) Dynamic Progressive bar. b) Display Video file using HTML5 video tag.

8. Develop a simple calculator to perform arithmetic (addition, subtraction, multiplication and division) operations on given two numbers. Use an HTML tag that allows the user to input two numbers and to display the result of arithmetic operation. Write suitable HTML and JavaScript and CSS to your simple calculator. The following figure show sample document display.




9. Develop and demonstrate using jQuery to solve the following: a) Limit character input in the text area including count. b) Based on check box, disable/enable the form submit button.
10. Develop and demonstrate using jQuery to solve the following: a) Fade in and fade out all division elements. b) Animate an element, by changing its height and width.

**Part-B**

**Develop a web application (course-project) using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. Database connection needs to be implemented.**

**Note:**

1. A team of two students must develop the mini project. However, during the examination, each student must demonstrate the project individually
2. Each student has to execute one program picked from Part-A during the semester end examination.
3. The team must submit a brief project report (20-25 pages) that must include the following
    a. Introduction
    b. Requirement Analysis
    c. Software Requirement Specification
    d. Analysis and Design, Implementation
    e. Testing
4. Brief synopsis not more than two pages to be submitted by the team as per the format given. It was recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Course-project projects.
5. Rubrics may be used to evaluate the Course-Project.

**Semester: I**

Course Name: **RESEARCH METHODOLOGY AND IPR**

| | | | |
|---|---|---|---|
| Course Code | 23MCA18 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Research Methodology:** Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India

**8 Hours**

**Module - 2**

**Defining the Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

**8 Hours**

**Module – 3**

**Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs

**8 Hours**

**Module – 4**

**Data Collection:** Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

**8 Hours**

**Module – 5**

**Intellectual Property (IP) Acts:** Introduction to IP: Introduction to Intellectual Property (IP), different types of IPs and its importance in the present scenario, Patent Acts: Indian patent acts 1970.Design Act: Industrial Design act 2000. Copy right acts: Copyright Act 1957. Trade Mark Act, 1999

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Research Methodology: Methods and Techniques | C.R. Kothari, Gaurav Garg | New Age International | 4th Edition, 2018. |
| 2 | Research Methodology a step-by- step guide for beginners. | Ranjit Kumar | SAGE Publications Ltd | 3rd Edition, 2011 |
| 3 | Intelectual property | Debirag E. Bouchoux | Cengage learning | 2013 |
| **Reference Books** | | | | |
| 1 | Research Methods: the concise knowledge base | Trochim | Atomic Dog Publishing | 2005 |
| 2 | Conducting Research Literature Reviews | Fink A | Sage Publications | 2009 |

**Semester: I**

Course Name: **BASICS OF PROGRAMMING AND COMPUTER ORGANISATION**
**(**BRIDGE COURSE**)**

| | | | |
|---|---|---|---|
| Course Code | 23MCA110-BC | CIE Marks | 100 |
| Teaching Hours/Week (L:T:P) | 2:0:0 | SEE Marks | --- |
| Total Hours of Pedagogy | 30 | Total Marks | 100 |
| Credits | 0 | Exam Hours | --- |

**Course Objectives:**

1. Elucidate the basic architecture and functionalities of a computer
2. Apply programming constructs of C language to solve the real-world problems
3. Explore user-defined data structures like arrays, structures and pointers in implementing solutions to problems
4. Apply the concept of structures and files to solve the real-world problems
5. Design and Develop solutions to problems using structured programming constructs such as functions and procedures

**Module – 1**

**Binary Systems and Combinational Logic:**
Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, subtraction using r's and r-1 complements, Binary Code, Binary Storage and Registers, Binary Logic, Integrated Circuits, Digital Logic Gates

**8 Hours**

**Module – 2**

**Introduction:** History of C, Structure of C program, Files used in a C program, Compilers, Compiling and executing C programs, tokens, Input/output statements in C, tokens, data types in C, Operators in C Type conversion and typecasting

**8 Hours**

**Module - 3**

**Decision Making and Looping statements:** Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements, goto statement.

**8 Hours**

**Module – 4**

**Functions:** Introduction using functions, function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions.
**Arrays:** Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, two dimensional arrays, operations on two-dimensional arrays, two- dimensional arrays to functions, multidimensional arrays, applications of arrays.

**8 Hours**

**Module – 5**

**Strings:** Introduction, string taxonomy, operations on strings, miscellaneous string and character functions, arrays of strings.
**Pointers:** Introduction to pointers, declaring pointer variables, types of pointers, passing arguments to functions using pointers

**8 Hours**

**Course Outcomes:**
1. Demonstrate the application of logic gates in solving some societal/industrial problems
2. Demonstrate the key concepts introduced in C programming by writing and executing the programs.
3. Demonstrate the concepts of structures and pointers for the given application/problem.
4. Implement the single/multi-dimensional array for the given problem.
5. Develop applications using the concepts of Structures, Pointers and Files

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer fundamentals and programming in C | Reema Thareja | Oxford University | 2nd Edition 2017 |
| 2 | Computer Organization | Carl Hamacher | Tata McGraw-Hill | 5th edition 2011 |
| **Reference Books** | | | | |
| 1 | Programming in ANSI C | E. Balaguruswamy | Tata McGraw-Hill. | 7th Edition |
| 2 | The 'C' Programming Language | Brian W. Kernighan and Dennis M. Ritchie | Prentice Hall of India | |

# 2nd Semester Syllabus

**Semester: II**

Course Name: **DATABASE MANAGEMENT SYSTEM**

| | | | |
|---|---|---|---|
| Course Code | 23MCA21 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction to Databases:** Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, A Brief History of Database Applications, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Centralized and client-server architectures, Classification of Database Management systems.

**8 Hours**

**Module - 2**

**Structure of Relational Databases:** Database Schema, Keys, Relational Query Languages, Relational Operations.
**Entity-Relationship Model:** Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types.

**8 Hours**

**Module – 3**

**SQL:** Overview of the SQL Query Language, SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, Insert, update and delete statements in SQL, aggregate functions in SQL, group by and having clauses.

**8 Hours**

**Module – 4**

**Normalization:** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

**8 Hours**

**Module – 5**

**Transaction Processing:** Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, transaction support in SQL.
**Concurrency control techniques:** two-phase locking techniques, concurrency control based on timestamp ordering, multi-version concurrency control techniques, validation concurrency control techniques.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Fundamentals of Database Systems | Elmasri and Navathe | Addison - Wesley | 5th Edition 2011 |
| 2 | Data base System Concepts | Silberschatz, Korth and Sudharshan | Tata McGraw Hil | 6th Edition 2011 |
| **Reference Books** | | | | |
| 1 | An Introduction to Database Systems | C.J. Date, A. Kannan, S. Swamynatham | Pearson Education | 8th Edition 2006 |
| 2 | Database Management Systems | Raghu Ramakrishnan and Johannes Gehrke | McGraw-Hill | 3rd Edition 2003 |

**Semester: II**

Course Name: **OBJECT ORIENTED PROGRAMMING WITH JAVA**

| | | | |
|---|---|---|---|
| Course Code | 23MCA22 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Data Types, Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.
**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses.
**Control Statements:** Java's Selection Statements, Iteration Statements

**8 Hours**

**Module - 2**

**Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, "This" Keyword, Garbage Collection.
**A Closer Look at Methods and Classes:** Overloading Methods.
**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

**8 Hours**

**Module – 3**

**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces.
**Exception Handling:** Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

**8 Hours**

**Module – 4**

**Generics Concept:** General Form of a Generic Class, Bounded Types, Generic Class Hierarchy, Generic Interfaces, Restrictions in Generics. Introduction to Lambda expression, Block Lambda Expressions, Generic Functional Interfaces. Passing lambda expressions as arguments - Lambda expressions and exceptions, Lambda expressions and variable capture.

**8 Hours**

**Module – 5**

**Collections:** Collection Interface, List Interface, Set Interface, SortedSet Interface, Queue Interface, ArrayList Class, LinkedList Class, HashSet Class, Using an Iterator, The for Each Statement.
**Introduction to JDBC:** Connecting to the database, Basic JDBC Operations, Essential JDBC Classes, JDBC Drivers, JDBC-ODBC Bridge, Connecting to a database with drivermanager, JDBC database URL

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Java The Complete Reference | Herbert Schildt | The McGraw Hill | 8th Edition, 2015 |
| 2 | J2EE Complete Reference | C Thomos | The McGraw Hill | 2nd Edition, 2001 |
| **Reference Books** | | | | |
| 1 | Programming with Java | Mahesh Bhave and Sunil Patekar | Pearson Education | 1st Edition,2008 |
| 2 | Programming with Java A primer | E Balagurusamy | Tata McGraw Hill | 3rd Edition,2007 |

**Semester: II**

Course Name: **COMPUTER NETWORKS**

| | | | |
|---|---|---|---|
| Course Code | 23MCA23 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 4:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 50 | Total Marks | 100 |
| Credits | 4 | Exam Hours | 03 |

**Module – 1**

**Foundation:** Problem, Requirements, Network Architecture, Implementing network software, Performance

**10 Hours**

**Module - 2**

**Direct Link Networks:** Hardware building blocks, Encoding, Framing, Error Detection, Reliable Transmission, Ethernet, Rings, Wireless

**10 Hours**

**Module – 3**

**Packet Switching:** Switching and Forwarding, Bridges and LAN Switches, Cell Switching, **Internetworking:** IP, Routing, Global Internet, Multicast.

**10 Hours**

**Module – 4**

**End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream (TCP), Congestion Control and Congestion Avoidance Mechanisms

**10 Hours**

**Module – 5**

**Network Security and Applications:** Cryptographic Tools, Key Redistribution, Firewalls, Traditional Applications, Web Services, Multimedia Applications

**10 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer Networks A Systems Approach | Larry L Peterson and Bruce S Davie | MKP | 5th Edition 2012 |
| 2 | Computer Networking, A Top-Down Approach | James F Kurose and Keith W Ross | Pearson | 6th Edition 2017 |
| 3 | Computer and Communication Networks | Nader F Mir | Pearson | 2nd Edition 2014 |
| **Reference Books** | | | | |
| 1 | Communication Networks – Fundamental Concepts & key architectures | Alberto Leon Garcia | Tata McGraw-Hill | 2nd Edition |
| 2 | Computer Networks | Andrew S Tanenbaum | Pearson | 5th Edition 2014 |

**Semester: II**

Course Name: **INTRODUCTION TO PYTHON**

| | | | |
|---|---|---|---|
| Course Code | 23MCA24 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40+20 | Total Marks | 100 |
| Credits | 4 | Exam Hours | 03 |

**Module – 1**

**Python Basics:** Variables, expressions and statements, Conditional execution, Functions

**8 Hours**

**Module - 2**

**Iteration:** While statement, Infinite Loops, definite loops, Loop patterns
**Strings:** String traversal, String Slices, in operator, String methods Format operator
**Files:** Persistence, Opening, reading from text files, using try, except and open, writing to text files

**8 Hours**

**Module – 3**

**Lists:** List Operations, slices, methods, lists and functions, list and strings, objects and value, Aliasing, List arguments
**Dictionaries:** Dictionary as a set of counters, Dictionaries and files, Looping and Dictionaries, Advanced text parsing

**8 Hours**

**Module – 4**

**Tuples:** Comparing tuples, Tuple assignment, Dictionaries and tuples, Sequences, List comprehension
**Regular Expressions:** Character matching in regular expressions, extracting data using regular expressions, Combining searching and extracting, Escape character

**8 Hours**

**Module – 5**

**Classes and objects:** Programmer-defined types, Attributes, Instances as return value, Objects are mutable, Copying
**Classes and functions:** Pure functions, modifiers, prototyping versus planning
**Classes and methods:** Object oriented features, init method, str method, operator overloading, type-based dispatch, polymorphism, Interface and implementation

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Python for Everybody: Exploring Data Using Python | Charles R. Severance | CreateSpace Independent Publishing Platform | 1st Edition, 2016 |
| 2 | Think Python: How to Think Like a Computer Scientist | Allen B. Downey | Green Tea Press | 2nd Edition, 2015 |
| **Reference Books** | | | | |
| 1 | Introduction to Computer Science Using Python | Charles Dierbach | Wiley India Pvt Ltd | 1st Edition |
| 2 | Programming Python | Mark Lutz | O'Reilly Media | 4th Edition, 2011 |

**PRACTICAL COMPONENT 20 Hours**

| SN | List of Experiments |
|---|---|
| 1 | Write a python program to demonstrate the use of Conditional execution statements |
| 2 | Write a python program to demonstrate the use of Iterative statements |
| 3 | Write a python program to demonstrate the use of Files |
| 4 | Write a python program to demonstrate the use of List and Dictionaries |
| 5 | Write a python program to demonstrate the use of Tuples |
| 6 | Write a python program to demonstrate the use of Regular Expressions |
| 7 | Write a python program to demonstrate the use of Classes and methods |

**Semester: II**

**PROFESSIONAL ELECTIVE - 1**

Course Name: **COMPUTER GRAPHICS WITH OPEN GL**

| Course Code | 23MCA251 | CIE Marks | 50 |
|---|---|---|---|
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Overview:** Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, graphics software. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms (DDA, Bresenham's), circle generation algorithms (Bresenham's).

**8 Hours**

**Module - 2**

**Fill area Primitives, 2D Geometric Transformations and 2D viewing:**

**Fill area Primitives:** Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions.

**8 Hours**

**Module – 3**

**Clipping, 3D Geometric Transformations, Color and Illumination Models:**

Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.

**8 Hours**

**Module – 4**

**3D Viewing and Visible Surface Detection:**

3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method only and OpenGL visibility detection functions.

**8 Hours**

**Module – 5**

**Input & interaction, Curves and Computer Animation:**
Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modeling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations. Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Computer Graphics with OpenGL Version | Donald Hearn & Pauline Baker | Pearson Education | 4th Edition 2011 |
| 2 | Interactive Computer Graphics- A Top Down approach with OpenGL | Edward Angel | Pearson Education | 5th Edition 2008 |
| | | | | |
| 1 | Computer graphics with OpenGL | James D Foley, Andries Van Dam, Steven K Feiner, John F Huges | Pearson Education | |
| 2 | Computer Graphics , sham‟s outline series | Xiang, Plastock | TMG | 2nd Edition |

**Semester: II**

**PROFESSIONAL ELECTIVE - 1**

Course Name: **CYBER SECURITY**

| | | | |
|---|---|---|---|
| Course Code | 23MCA252 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction to Cybercrime:**
**Cybercrime:** Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals.
**Classifications of Cybercrimes:** An Indian Perspective, Hacking and Indian Laws., Global Perspectives

**8 Hours**

**Module - 2**

**Cyber Offenses:**
**How Criminals Plan Them:** Introduction, how criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber Cafe & cybercrimes.
**Botnets:** The fuel for cybercrime, Attack Vector

**8 Hours**

**Module – 3**

**Tools and Methods used in Cybercrime:** Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks.

**8 Hours**

**Module – 4**

**Phishing and Identity Theft:** Introduction, methods of phishing, phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft.

**8 Hours**

**Module – 5**

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives | Sunit Belapure and Nina Godbole | Wiley India Pvt Ltd | 1st Edition, 2011 |
| **Reference Books** | | | | |
| 1 | Cyber-security Lessons for Everyone | Neil Daswani, Moudy Elbayadi Big Breaches | | 2021 |

**Semester: II**

**PROFESSIONAL ELECTIVE - 1**

Course Name: **USER INTERFACE DESIGN**

| | | | |
|---|---|---|---|
| Course Code | 23MCA253 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction:**
**Usability of Interactive Systems:** Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Goals for our profession.
**Guideline, principles, and theories:** Introduction, Guidelines, principles, Theories.

**8 Hours**

**Module - 2**

**Development Processes:**
**Managing Design Processes:** Introduction, Organizational Design to support Usability, The Four Pillars of Design
**Development methodologies:** Ethnographic Observation, Participatory Design, Scenario Development, Social Impact statement for Early Design Review, Legal Issues.
**Evaluating Interface Design:** Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments

**8 Hours**

**Module – 3**

**Direct Manipulation and Virtual Environments:** Introduction, Examples of Direct Manipulation, Discussion of direct manipulation, 3D Interfaces, Tele-operation, Virtual and Augmented Reality Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry with Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays

**8 Hours**

**Module – 4**

**Command and Natural Languages:** Introduction, Command-organization functionality strategies and structure, Naming and Abbreviations, Natural Language in computing. Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory interfaces, Displays-Small and Large
**Design Issues** Quality of Service: Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response time, Frustrating Experiences Balancing Function and Fashion: Introduction, Error Messages, Non anthropomorphic Design, Display design, web page design, Window Design, Color

**8 Hours**

**Module – 5**

**User Documentation and Online Help:** Introduction, Online versus paper documentation, Reading from paper versus Displays, Shaping the content of the Manuals, Accessing the Documentation, Online Tutorials and animated demonstrations, Online Communities for User Assistance, The Development Process.
**Information Search and Visualization:** Introduction, Search in Textual Documents and Database Querying, Multimedia document searches, Advanced filtering and Search Interfaces, Information Visualization: Introduction, Data type by task taxonomy, Challenges for information visualization.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Designing the User Interface | Ben Shneiderman, Plaisant, Cohen, Jacobs | Pearson Education | 5th Edition 2010 |
| **Reference Books** | | | | |
| 1 | Human-Computer Interaction | Alan Dix, Janet Finalay, Gregory D Abiwdm Russel Bealel | Pearson Education | 3rd Edition 2008 |
| 2 | User Interface Design | Eberts | Wiley-Dreamtech India Pvt Ltd | 2011 |

**Semester: II**

**PROFESSIONAL ELECTIVE - 1**

Course Name: **INTRODUCTION TO DATA ANALYTICS**

| | | | |
|---|---|---|---|
| Course Code | 23MCA254 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction to Data Analytics:**
Introduction, Business Intelligence, Pattern Recognition, Data Processing Chain, Business Intelligence Concepts and Applications: Introduction, BI for better decisions, decision types, BI tools, BI skills, BI applications. **8 Hours**

**Module - 2**

**OLTP and Data Warehousing:**
Online Transaction Processing, OLTP system characteristics, OLTP merits and demerits, need of data warehouse, characteristics of DW, main components of data warehouse, approaches for constructing a data warehouse, dimensional modeling used in DW design-facts, dimensions and attributes, types of schemas, ETI and other tools sets available in market. **8 Hours**

**Module – 3**

**Business Intelligence and its Deeper Dynamics:**
Business Intelligence, BI characteristics, data quality: a real challenge, data quality best practices, structured versus unstructured, differences between structured and unstructured data, data lake, data lake versus data warehouse, main components of a data lake, modern business intelligence system, benefits and use cases of modern BI. **8 Hours**

**Module – 4**

**Data Visualization-1:**
Presenting data visualization, aims of data visualization, history at a glance, importance of data visualization, types of data visualization-hierarchical, tree diagram, tree map, ring chart, dendogram, temporal, bar chart, line graph, stacked graph, Gantt chart, scatter plot, stacked area chart, sparkline, network, word cloud, matrix chart, node link diagram, multi-dimensional, pie chart, histogram. **8 Hours**

**Module – 5**

**Data Visualization-2:**
Decision tree problem, decision tree construction, decision tree algorithms.
**Advanced data visualization**- structure, objective, types of advanced data visualization-bubble chart, word cloud, geospatial heat map/ hot spot mapping, data visualization trends, introducing data visualization tools, data visualization best practices.
**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Data Analytics | Anil Maheshwari | Mc Graw Hill Education | 2018 |
| **Reference Books** | | | | |
| 1 | Data Analytics: Principles, Tools,and Practices | Dr.Gaurav Aroraa<br>Chitra Lele<br>Dr.Munish Jindal | BPB Publications | 1st Edition, 2022 |

**Semester: II**

**PROFESSIONAL ELECTIVE - 2**

Course Name: **INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

| | | | |
|---|---|---|---|
| Course Code | 23MCA261 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction:** Definition of AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence.
**Intelligent Agents:** Agents and Environments
**Good Behavior:** The concept of rationality, the nature of Environments, the structure of Agents.

**8 Hours**

**Module - 2**

**Problem solving by searching:** Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions

**8 Hours**

**Module – 3**

**Introduction to Machine Learning:** Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.
**Understanding Data:** What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization.

**8 Hours**

**Module – 4**

**Understanding Data:** Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,
**Basics of Learning Theory:** Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.
**Similarity-based learning:** Introduction to Similarity or instance based learning, Nearest-neighbour learning, weighted K- Nearest - Neighbour algorithm.

**8 Hours**

**Module – 5**

**Artificial Neural Network:** Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial Neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Artificial Intelligence A Modern Approach | Stuart Russel, Peter Norvig | Pearson Education | 3rd Edition, 2015 |
| | Machine Learning | S. Sridhar, M Vijayalakshmi | Oxford | 2021 |
| **Reference Books** | | | | |
| 1 | Artificial Intelligence | Elaine Rich, Kevin Knight | Tata McGraw Hill | 3rd Edition, 2009 |
| 2 | Principles of Artificial Intelligence | Nils J. Nilsson | Elsevier | 1980 |

**Semester: II**

**PROFESSIONAL ELECTIVE - 2**

Course Name: **MOBILE APPLICATION DEVELOPMENT**

| | | | |
|---|---|---|---|
| Course Code | 23MCA262 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Enumerations, Autoboxing and Annotations(metadata):** Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations atruntime by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

**8 Hours**

**Module - 2**

**String Handling :**The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals() Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse(), delete( )and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder

**8 Hours**

**Module – 3**

**Getting Started with Android Programming:** Definition of Android, Features of Android, Android Architecture, obtaining the required tools, launching your first android application.
**Activities, Fragments and Intents:** Understanding activities, linking activities using intents, fragments

**8 Hours**

**Module – 4**

**Getting to know the Android User Interface:** Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView
**Designing User Interface with Views:** TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews, ProgressBar View, AutoCompleteTextView View, TimePicker View, DatePickerView, ListView View, SpinnerView

**8 Hours**

**Module – 5**

**Understanding Specialized Fragments:** List Fragment, DialogFragment, PreferenceFragment
**Creating and using Databases:** Creating the DBAdapter Helper class, using the database programmatically

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | JAVA The Complete Reference | Herbert Schildt | Tata McGrawHill | $7^{th}/9^{th}$ 2007 |
| 2 | J2EE The Complete Reference | Jim Keogh | Tata McGrawHill | 2007 |
| 3 | Beginning Android Programming with Android Studio | J. F. DiMarzio | 4thEdition | 2017 |
| **Reference Books** | | | | |
| 1 | Android Programming for Beginners | John Horton | 1stEdition | 2015 |
| 2 | Head First Android Development | Dawn Griffiths & David Griffiths | O'Reilly, 1stEdition | 2015 |

**Semester: II**

**PROFESSIONAL ELECTIVE - 2**

Course Name: **DISTRIBUTED OPERATING SYSTEM**

| | | | |
|---|---|---|---|
| Course Code | 23MCA263 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Fundamentals:** Definition, Meaning of Distributed Computing Systems, Evolution of Distributed Computing System, Distributed Computing System Models, Distributed Operating System, Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE).

**Message Passing:** Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

**8 Hours**

**Module - 2**

**Remote Procedure Calls**: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC.

**8 Hours**

**Module – 3**

**Distributed Shared Memory:** Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

**8 Hours**

**Module – 4**

**Resource Management:** Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach

**Process Management:** Introduction, Process Migration, Threads.

**8 Hours**

**Module – 5**

**Distributed File Systems:** Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Distributed Operating Systems: Concepts and Design | Pradeep. K. Sinha | PHI | 2007 |
| **Reference Books** | | | | |
| 1 | Distributed Operating Systems | Andrew S. Tanenbaum | Pearson Education | 2013 |

**Semester: II**

**PROFESSIONAL ELECTIVE - 2**

Course Name: **NATURAL LANGUAGE PROCESSING**

| | | | |
|---|---|---|---|
| Course Code | 23MCA264 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Module – 1**

**Introduction, Morphology:** Knowledge in Speech & Language Processing, Ambiguity, Models & Algorithms, Language, Thought & Understanding, Some Brief History, The State of the Art & Near-Term Future, Summary Morphology and Finite State Transducers: Survey of English Morphology, Finite state Morphological Parsing, Lexicon-Free FST: The Porter Stemmer, Human Morphological Parsing, Summary, Combining FST Lexicon and Rules.

**8 Hours**

**Module - 2**

**N-Grams:** Counting Words in Corpora, Simple N-Grams, Smoothing, Back off, Deleted Interpolation, N-Grams for Spelling and Pronunciation, Entropy, Summary. Word Classes and Part-of- Speech Tagging: English Word Classes, Tag sets for English, Part-of-Speech Tagging.

**8 Hours**

**Module – 3**

**Context-Free Grammars and Predicate Calculus for English:** Constituency, Context-Free Rules and Trees, Sentence Level Constructions, Coordination, Agreement, The Verb Phrase Sub Categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence and Normal Form, Finite –State and Context- Free Grammars, Grammars and Human Processing, The Early Algorithm, Finite-State Parsing Method, Summary Representing Meaning

**8 Hours**

**Module – 4**

**Semantic Analysis:** Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Earley Parser, Idioms and Compositionality, Robust Semantic Analysis, Summary. Lexical Semantics: Relations Among Lexemes and Their Senses, WordNet: A Database of Lexical Relations, The Internal Structure of Words, Creativity and the Lexicon, Summary Word Sense Disambiguation and Information

**8 Hours**

**Module – 5**

**Retrieval:** Selection Restriction Based Disambiguation, Robust Word Sense Disambiguation, Information Retrieval, Other Retrieval Tasks, and Summary. Case Study of Simple Text Recognition or Content Based Text Extraction System. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.

**8 Hours**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition | Daniel Jurafsky and James H Martin | Prentice Hall | 2nd Edition 2009 |
| **Reference Books** | | | | |
| 1 | Foundations of Statistical Natural Language Processing | Christopher D.Manning and Hinrich Schutze, | MIT Press | 1999 |
| 2 | Natural Language Processing and Information Retrieval | Tanveer Siddiqui, U.S. Tiwary | Oxford University Press | 2008 |

**Semester: II**

Course Name: **DBMS LAB**

| | | | |
|---|---|---|---|
| Course Code | 23MCAL27 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:4 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 2 | Exam Hours | 03 |

**Instructions:**
1. Draw ER diagram based on given scenario with various Constraints.
2. Create Relational Database Schema based on the scenario using Mapping Rules.
3. Perform the given queries using any RDBMS Environment.
4. Suitable tuples have to be entered so that queries are executed correctly.
5. The results of the queries may be displayed directly.
6. Design a front end to retrieve the data
7. Generate Reports

**1.Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries.**

BRANCH (Branchid, Branchname, HOD)
STUDENT (USN, Name, Address, Branchid, sem)
BOOK (Bookid, Bookname, Authorid, Publisher, Branchid)
AUTHOR (Authorid, Authorname, Country, age)
BORROW (USN, Bookid, Borrowed_Date)

**Execute the following Queries:**

i. List the details of Students who are all studying in 2nd sem MCA.
ii. List the students who are not borrowed any books.
iii. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2nd sem MCA Students who borrowed books.
iv. Display the number of books written by each Author.
v. Display the student details who borrowed more than two books.
vi. Display the student details who borrowed books of more than one Author.
vii. Display the Book names in descending order of their names.
viii. List the details of students who borrowed the books which are all published by the same publisher.

**2. Consider the following schema:**

STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA)

**Execute the following queries:**

i. Update the column total by adding the columns mark1, mark2, mark3.
ii. Find the GPA score of all the students.
iii. Find the students who born on a particular year of birth from the date_of_birth column.
iv. List the students who are studying in a particular branch of study.
v. Find the maximum GPA score of the student branch-wise.
vi. Find the students whose name starts with the alphabet “S”.
vii. Find the students whose name ends with the alphabets “AR”.
viii. Delete the student details whose USN is given as 1001.

**3. Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries.**
Consider a Cricket Tournament "ABC CUP" organized by an organization. In the tournament there are many teams are contesting each having a Teamid, Team_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers, age. A player represents only one team. There are many Stadiums to conduct matches. Each stadium is identified using Stadiumid, having a stadium_name, Address (involves city, area_name, pincode). A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man_of_the match award given to a player.
**Execute the following Queries:**

i. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
ii. List the details of the stadium where the maximum number of matches were played.
iii. List the details of the player who is not a captain but got the man_of _match award at least in two matches.
iv. Display the Team details who won the maximum matches.
v. Display the team name where all its won matches played in the same stadium.

**4. Design an ER-diagram for the following scenario,** Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries. A country can have many Tourist places . Each Tourist place is identified by using tourist_place_id, having a name, belongs to a state, Number of kilometers away from the capital city of that state,history. There are many Tourists visits tourist places every year. Each tourist is identified uniquely by using Tourist_id, having a Name, age, Country and multiple emailids. A tourist visits many Tourist places, it is also required to record the visted_date in the database. A tourist can visit a Tourist place many times at different dates. A Tourist place can be visited by many tourists either in the same date or at different dates.
**Execute the following Queries:**

i. List the state name which is having maximum number of tourist places.
ii. List details of Tourist place where maximum number of tourists visited.
iii. List the details of tourists visited all tourist places of the state "KARNATAKA".
iv. Display the details of the tourists visited at least one tourist place of the state, but visited all states tourist places.
v. Display the details of the tourist place visited by the tourists of all country.

5. **A country wants to conduct an election for the parliament**. A country having many constituencies. Each constituency is identified uniquely by Constituency_id, having the Name, belongs to a state, Number_of_voters. A constituency can have many voters. Each voter is uniquely identified by using Voter_id, having the Name, age, address (involves Houseno, city, state, pincode). Each voter belongs to only one constituency. There are many candidates contesting in the election. Each candidate is uniquely identified by using candidate_id, having Name, phone_no, age, state. A candidate belongs to only one party. Thereare many parties. Each party is uniquely identified by using Party_id, having Party_Name, Party_symbol. A candidate can contest from many constituencies under a same party. A party can have many candidates contesting from different constituencies. No constituency having the candidates from the same party. A constituency can have many contesting candidates belongs to different parties. Each voter votes only one candidate of his/her constituency.

**Execute the following Queries:**

i. List the details of the candidates who are contesting from more than one constituencies which are belongs to different states.
ii. Display the state name having maximum number of constituencies.
ii. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18 years old, then insert the tuple into the voter else display the "Not an eligible voter msg".
v. Create a stored procedure to display the number_of_voters in the specified constituency. Where the constituency name is passed as an argument to the stored procedure.
v. Create a TRIGGER to UPDATE the count of " Number_of_voters" of the respective constituency in "CONSTITUENCY" table , AFTER inserting a tuple into the "VOTERS" table.

**Part-B**

**Design, Develop and implement an application software(course-project) using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. Database connection needs to be implemented.**

**Note:**

1. A team of two students must develop the course project. However, during the examination, each student must demonstrate the project individually
2. Each student has to execute one program picked from Part-A during the semester end examination.
3. The team must submit a brief project report (20-25 pages) that must include the following
   a. Introduction
   b. Requirement Analysis
   c. Software Requirement Specification
   d. Analysis and Design, Implementation
   e. Testing
4. Brief synopsis not more than two pages to be submitted by the team as per the format given. It was recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Course-project projects.
5. Rubrics may be used to evaluate the Course-Project.

**Semester: II**

Course Name: **JAVA PROGRAMMING LAB**

| | | | |
|---|---|---|---|
| Course Code | 23MCAL28 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 0:0:4 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 2 | Exam Hours | 03 |

1. Write a JAVA program to demonstrate Constructor Overloading and Method Overloading.
2. Write a JAVA program to implement Inner class and demonstrate its Access protection.
3. Write a program in Java for String handling which performs the following:
   a. Checks the capacity of String Buffer objects.
   b. Reverses the contents of a string given on console and converts the resultant string in upper case.
   c. Reads a string from console and appends it to the resultant string of (ii).
4. Write a JAVA program to demonstrate Inheritance.
Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
5. Write a JAVA program which has:
   a. A Class called Account that creates account with Rs. 500 minimum balance, a deposit() method to deposit amount, a withdraw() method to withdraw amount and also throws LessBalanceException if an account holder tries to withdraw money which makes the balance become less than Rs. 500.
   b. A Class called Less_Balance_Exception which returns the statement that says withdraw amount (Rs.) is not valid.
   c. A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a Less Balance Exception take appropriate action for the same.
6. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.
7. Write a JAVA program to implement a Queue using user defined Exception Handling (also make use of throw, throws).
   a. Complete the following:
   b. Create a package named shape.
   c. Create some classes in the package representing some common shapes like Square, Triangle, and Circle.
   d. Import and compile these classes in other program.
8. Write a JAVA program to implement AarrayList class in collection
9. Write a Java program to implement a lambda expression to remove duplicates from a list of integers
10. Write a JAVA program to establish connection to JDBC-ODBC Bridge

**Semester: I**

**Engineering science course**

Course Name: **ELEMENTS OF MECHANICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **22EME13/23** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 3 | Exam Hours | 03 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |

Course Learning Objectives

- To develop basic Knowledge on Mechanical Engineering, Fundamentals and Energy Sources.
- Understand the concept of different types of Machine tool operations and Modern Manufacturing Processes like CNC, 3D printing.
- To know the concept of IC engines and Future Mobility vehicles.
- To give exposure in the field of Engineering Materials and Manufacturing Processes Technology and its applications

To acquire a basic understanding role of Mechanical Engineering in the Robotics and Automation in industry.

Teaching-Learning Process

Teaching-Learning Process

Adopt Problem Based Learning (PBL), which fosters students' Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Arrange visits to show the live working models other than laboratory topics.
- Adopt collaborative (Group Learning) Learning in the class.

**Module – 1**

**Introduction to Mechanical Engineering** (Overview only):
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Steam Formation and Application:**
Modes of heat transfer, Steam formation, Types of steam, Steam properties and applications of steam (simple numerical problems).

**Energy Sources and Power Plants:**
Basic working principles of Hydel power plant, Thermal power plant, nuclear power plant, Solar power plant, Tidal power plant and Wind power plant.

**08 Hours**

**Module - 2**

**Machine Tool Operations:**

**Lathe**: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, thread cutting, taper turning by swiveling the compound rest,

**Drilling Machine**: Working of simple drilling machine, drilling operations: drilling, boring, reaming, tapping, counter sinking, counter boring,

**Milling Machine**: Working methods of milling (up milling and Down milling), milling operations: plane milling, end milling and slot milling.

(No sketches of machine tools, sketches to be used only for explaining the operations).

**Introduction to Advanced Manufacturing Systems:** Introduction, components of CNC,advantages and applications of CNC, 3D printing.

**08 Hours**

**Module – 3**

**Introduction to IC Engines**: Components and working principles, 4-Stroke Petrol and Diesel engines, Application of IC Engines, performance of IC engines (Simple numerical).

**Introduction to Refrigeration and Air Conditioning**: Principle of refrigeration, Refrigerants, and their desirable properties. Working principle of VCR and VAR refrigeration system, working principle of room air conditioner & Applications of air Conditioners.

**08 Hours**

**Module - 4**

**Mechanical Power Transmission:**

Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, simple and compound gear trains (simple numerical problems)

Belt Drives: Introduction, Types of belt drives (Flat and V-Belt Drive)

**Joining Processes**: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding, (types of flames), TIG welding, MIG welding, Thermit welding, Laser beam welding and Electron beam welding processes

**08 Hours**

**Module – 5**

**Insight into future mobility technology;** Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of Electric Vehicles (EVs) and Hybrid vehicles.

**Introduction to Mechatronics and Robotics:** open-loop and closed-loop mechatronic systems. Robot anatomy, Applications of Robots in material handling, processing and assembly and inspection.

**08 Hours**

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | |
|---|---|
| **CO1** | Acquire a basic understanding about scope of mechanical engineering, fundamentals about steam and nonconventional energy sources. |
| **CO2** | Acquire a basic knowledge about conventional and advanced manufacturing processes. |
| **CO3** | Acquiring a basic understanding about IC engines, propulsive devices, and air-conditioner |
| **CO4** | Acquiring a basic knowledge about power transmission and joining processes. |
| **CO5** | Acquiring a basic insight into future mobility and mechatronics and robotics. |

Assessment Details:

CIE:

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools (AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications, and other cooperative and problem-based learning.

**(Preferred pattern of all tests are like the SEE pattern, however; teacher may follow the CIE test pattern of other engineering courses)**

**Two assignments each of 10 Marks**

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

Three Unit Tests each of 20 Marks (duration 01 hour)

First test at the end of 5th week of the semester

Second test at the end of the 10th week of the semester

Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

First assignment at the end of 4th week of the semester

Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours) at the end of the 13th week of the semester.

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

**Semester End Examination (SEE):**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.

The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students must answer 5 full questions, selecting one full question from each module. The student must answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.

**There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub-questions), should have a mix of topics under that module.**

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Engineering Design | John. Kurnitz, Stephen O'Brien and John P. Hutchinson | Cengagelearning | Second Edition, 2013 |
| 2 | The Design of Business | Roger Martin | Harvard Business Press | 2009 |
| 3 | Design Thinking: Understand – Improve – Apply | Hasso Plattner, Christoph Meinel and Larry Leifer | Springer | 2011. |
| Reference Books | | | | |
| 1 | Design Thinking for Strategic Innovation | Idris Mootee | John Wiley & Sons | Second Edition, 2011. |
| 2 | Engineering Design Process | Yousef Haik and Tamer M. Shahin | Cengage Learning | 1st edition, 2012 |

E-Resources:


17. www.tutor2u.net/business/presentations/. /Product lifecycle/default.html
18. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
19. www.bizfilings.com › Home › Marketing › Product Development
20. https://www.mindtools.com/brainstm.html
21. https://www.quicksprout.com/. /How-to-reverse-engineer-your-competitor
22. www.vertabelo.com/blog/documentation/reversengineering
23. \https://support.microsoft.com/en-us/kb/273814
24. https://support.google.com/docs/answer/179740?hl=en
25. https://www.youtube.com/watch?v=2mjSDIBaUlMthevirtualinstructor.com/foreshortening.html
26. https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf
27. https://dschool.stanford.edu/use-our-methods/
28. https://www.interaction-design.org/literature/article/stages-in-the-design-thinking-process
29. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8.
30. https://www.nngroup.com/articles/design-thinking/
31. https://designthinkingforeducators.com/design-thinking/
32. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf


Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
http://dschool.stanford.edu/dgift/

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

Autonomous Institute under VTU,Belagavi | Approved by AICTE,New Delhi | Recognized by Govt. of Karnataka

**BE/B.Tech. Scheme of Teaching and Examinations-2022**
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**
**(Effective from the academic year 2022-23)**

# MECHANICAL ENGINEERING

| SN | Category |
|---|---|
| 1 | **ASC**-Applied Science Course. |
| 2 | **ESC**- Engineering Science Courses. |
| 3 | **ETC**- Emerging Technology Course. |
| 4 | **PLC-** Programming Language Course. |
| 5 | **AEC**- Ability Enhancement Course. |
| 6 | **HSMC**-Humanity and Social Science and management Course. |
| 7 | **AEC**- Ability Enhancement Course. |
| 8 | **SDC**- Skill Development Course. |
| 9 | **IC** – Integrated Course (Theory Course Integrated with Practical Course). |
| 10 | |
| 11 | |
| 12 | |

# I Semester

## Scheme of Teaching and Examination 2022-23
## Outcome-Based Education(OBE) and Choice Based Credit System(CBCS) (Effective from the academic year 2022-23)

**For Physics Group**

**I Semester (Mechanical Engineering Stream)**

| Sl. No | Course and Course Code | | Course title | TD/PSB | Teaching Hours/Week: Theory Lecture (L) | Tutorial (T) | Practical/ Drawing (P) | SDA (S) | Examination: Duration in hours | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *ASC(IC) | 22MATM11 | Mathematics for MES-I | Maths | 2 | 2 | 2 | 0 | 03 | 50 | 50 | 100 | 04 |
| 2 | #ASC(IC) | 22PHYM12 | Physics for MES | PHY | 2 | 2 | 2 | 0 | 03+02 | 50 | 50 | 100 | 04 |
| 3 | ESC | 22EME13 | Elements of Mechanical Engineering | Mechanical | If offered as theory course | | | | 03 | 50 | 50 | 100 | 03 |
| | | | | | 2 | 2 | 0 | 0 | | | | | |
| | | | | | If offered as Integrated course | | | | | | | | |
| | | | | | 2 | 0 | 2 | 0 | | | | | |
| 4 | ESC-I | 22ESC14x | Engineering Science Course-I | Respective Engg Dept. | 3 | 0 | 0 | 0 | 03 | 50 | 50 | 100 | 03 |
| 5 | ETC-I | 22ETC15x | Emerging Technology Course-I | Any Engineering Dept | 3 | 0 | 0 | 0 | 03 | 50 | 50 | 100 | 03 |
| | OR | | | | | | | | | | | | |
| | PLC-I | 22PLC15x | Programming language Course-I | | 2 | 0 | 2 | 0 | 03+02 | | | | |
| 6 | AEC | 22ENG16 | Communicative English | Humanities | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| 7 | HSMC | 22KSK17/ 22KBK17 | Samskrutika Kannada/ Balake Kannada | Humanities | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22ICO17 | Indian Constitution | | | | | | | | | | |
| 8 | AEC/SDC | 22IDT18 | Innovation and Design Thinking | Any Dept | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22SFH18 | Scientific Foundations of Health | | 1 | 0 | 0 | 0 | 01 | | | | |
| | | | | **TOTAL** | | | | | | **400** | **400** | **800** | **20** |

**SDA**-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMS**-Humanity and Social Science and management Course, **SDC**- Skill Development Course, **CIE**–Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

| | |
|---|---|
| **Credit Definition:**<br>1- hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit**<br>2- hours Practical / Drawing (**P**) per week=**1Credit**<br>**2-**hous Skill Development Actives **(SDA)** per week = **1 Credit** | 04-Credits courses are to be designed for 50 hours of Teaching-Learning Session<br>04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practicalsessions<br>03-Credits courses are to be designed for 40 hours of Teaching-Learning Session<br>02- Credits courses are to be designed for 25 hours of Teaching-Learning Session<br>01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions |

**Student's Induction Program:** Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXURE- I of Induction Programs notification of the University published at the beginning of the 1st semester.

**AICTE Activity Points** to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

***-22MATM11** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

**#-22PHYM12** SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

**ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0 ).

**All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

| (ESC-I) Engineering Science Courses-I | | | | | (ETC-I ) Emerging Technology Courses-I | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Code** | **Title** | **L** | **T** | **P** | **Code** | **Title** | **L** | **T** | **P** |
| 22ESC141 | Introduction to Civil Engineering | 3 | 0 | 0 | 22ETC15A | Smart Materials and Systems | 3 | 0 | 0 |
| 22ESC142 | Introduction to Electrical Engineering | 3 | 0 | 0 | 22ETC15B | Green Buildings | 3 | 0 | 0 |
| 22ESC143 | Introduction to Electronics Engineering | 3 | 0 | 0 | 22ETC15C | Operation and Maintenance of Solar ElectricSystems | 3 | 0 | 0 |
| 22ESC144 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 22ETC15D | Introduction to Embedded System | 3 | 0 | 0 |
| 22ESC145 | Introduction to C Programming | 2 | 0 | 2 | 22ETC15E | Introduction to Nano Technology | 3 | 0 | 0 |
| | | | | | 22ETC15F | Introduction to Drone Technology | 3 | 0 | 0 |
| | | | | | 22ETC15G | Introduction to Sustainable Engineering | 3 | 0 | 0 |
| | | | | | 22ETC15H | Renewable Energy Sources | 3 | 0 | 0 |
| | | | | | 22ETC15I | Waste Management | 3 | 0 | 0 |
| | | | | | 22ETC15J | Emerging Applications of Biotechnology | 3 | 0 | 0 |
| | | | | | 22ETC15K | Introduction to Internet of Things (IOT) | 3 | 0 | 0 |
| | | | | | 22ETC15L | Introduction to Cyber Security | 3 | 0 | 0 |
| | | | | | | | | | |
| **(PLC-I) Programming Language Courses-I** | | | | | | | | | |
| **Code** | **Title** | **L** | **T** | **P** | | | | | |
| 22PLC15A | Introduction to Web Programming | 2 | 0 | 2 | | | | | |
| 22PLC15B | Introduction to Python Programming | 2 | 0 | 2 | | | | | |
| 22PLC15C | Basics to JAVA programming | 2 | 0 | 2 | | | | | |
| 22PLC15D | Introduction to C++ Programming | 2 | 0 | 2 | | | | | |

- The student has to select one course from the ESC-I group.
- MES stream Students shall opt for any one of the courses from the ESC-I group **except, 22ESC144-Introduction to MechanicalEngineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

# II Semester
## Scheme of Teaching and Examination 2022-23
## Outcome-Based Education (OBE) and Choice Based Credit System(CBCS)
## (Effective from the academic year 2022-23)

**For Physics Group(For the students who attend the 1st semester under Physics Group)**

**II Semester (Mechanical Engineering Stream)**

| Sl. No | Course and Course Code | | Course title | TD/PSB | Teaching Hours/Week | | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | SDA | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | *ASC(IC) | 22MATM21 | Mathematics for MES-II | Maths | 2 | 2 | 2 | 0 | 03 | 50 | 50 | 100 | 04 |
| 2 | #ASC(IC) | 22CHE22 | Chemistry for MES | Chemistry | 2 | 2 | 2 | 0 | 03+02 | 50 | 50 | 100 | 04 |
| 3 | ESC | 22CED23 | Computer-Aided Engineering Drawing | Mechanical | 2 | 0 | 2 | 0 | 03 | 50 | 50 | 100 | 03 |
| 4 | ESC-II | 22ESC24x | Engineering Science Course-II | Respective Engg Dept. | 3 | 0 | 0 | 0 | 03 | 50 | 50 | 100 | 03 |
| 5 | PLC-II | 22PLC25x | Programming language Course-II | Any Engineering Dept | 3 | 0 | 0 | 0 | 03+02 | 50 | 50 | 100 | 03 |
| | OR | | | | | | | | | | | | |
| | ETC-II | 22ETC25x | Emerging Technology Course-II | | 3 | 0 | 0 | 0 | 03 | | | | |
| 6 | AEC | 22PWS26 | Professional Writing Skills in English | Humanities | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| 7 | HSMC | 22KSK27/ 22KBK27 | Samskrutika Kannada/ Balake Kannada | Humanities | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22ICO27 | Indian Constitution | | | | | | | | | | |
| 8 | AEC/SDC | 22IDT28 | Innovation and Design Thinking | Any Dept | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22SFH28 | Scientific Foundations of Health | | 1 | 0 | 0 | 0 | 01 | | | | |
| | | | | TOTAL | | | | | | 400 | 400 | 800 | 20 |

**SDA**-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMS**-Humanity and Social Science and management Course, **SDC**- Skill Development Course, **CIE**–Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

***-22MATM21** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

**#-22CHEM22-** SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

**ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0 )

**All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

| **(ESC-II) Engineering Science Courses-II** | | | | | **(ETC-II) Emerging Technology Courses-II** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Code** | **Title** | **L** | **T** | **P** | **Code** | **Title** | **L** | **T** | **P** |
| 22ESC241 | Introduction to Civil Engineering | 3 | 0 | 0 | 22ETC25A | Smart materials and Systems | 3 | 0 | 0 |
| 22ESC242 | Introduction to Electrical Engineering | 3 | 0 | 0 | 22ETC25B | Green Buildings | 3 | 0 | 0 |
| 22ESC243 | Introduction to Electronics Engineering | 3 | 0 | 0 | 22ETC25C | Operation and Maintenance of Solar ElectricSystems | 3 | 0 | 0 |
| 22ESC244 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 22ETC25D | Introduction to Embedded System | 3 | 0 | 0 |
| 22ESC245 | Introduction to C Programming | 2 | 0 | 2 | 22ETC25E | Introduction to Nano Technology | 3 | 0 | 0 |
| | | | | | 22ETC25F | Introduction to Drone Technology | 3 | 0 | 0 |
| | | | | | 22ETC25G | Introduction to Sustainable Engineering | 3 | 0 | 0 |
| | | | | | 22ETC25H | Renewable Energy Sources | 3 | 0 | 0 |
| | | | | | 22ETC25I | Waste Management | 3 | 0 | 0 |
| | | | | | 22ETC25J | Emerging Applications of Biotechnology | 3 | 0 | 0 |
| | | | | | 22ETC25K | Introduction to Internet of Things(IoT) | 3 | 0 | 0 |
| | | | | | 22ETC25L | Introduction to Cyber Security | 3 | 0 | 0 |
| | | | | | | | | | |
| **(PLC-II) Programming Language Courses-II** | | | | | | | | | |
| **Code** | **Title** | **L** | **T** | **P** | | | | | |
| 22PLC25A | Introduction to Web Programming | 2 | 0 | 2 | | | | | |
| 22PLC25B | Introduction to Python Programming | 2 | 0 | 2 | | | | | |
| 22PLC25C | Basics of JAVA programming | 2 | 0 | 2 | | | | | |
| 22PLC25D | Introduction to C++ Programming | 2 | 0 | 2 | | | | | |

- The student has to select one course from the ESC-II group.
- Mechanical Engineering stream Students shall opt for any one of the courses from the ESC-II group **except, 22ESC244-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

# I Semester
## Scheme of Teaching and Examination 2022-23
## Outcome-Based Education (OBE) and Choice Based Credit System(CBCS)
## (Effective from the academic year 2022-23)

**I Semester (Mechanical Engineering Stream)** **(For Chemistry group)**

| Sl.No | Course and Course Code | | Course Title | TD/PSB | Teaching Hours/Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | SDA | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | *ASC(IC) | 22MATM11 | Mathematics for ME Streams-I | Maths | 2 | 2 | 2 | 0 | 03 | 50 | 50 | 100 | 04 |
| 2 | #ASC(IC) | 22CHEE12 | Chemistry for ME Streams | Chemistry | 2 | 2 | 2 | 0 | 03+02 | 50 | 50 | 100 | 04 |
| 3 | ESC | 22CED13 | Computer Aided Engineering Drawing | Civil/Mech Enggdept | 2 | 0 | 2 | 0 | 03 | 50 | 50 | 100 | 03 |
| 4 | ESC-I | 22ESC14x | Engineering Science Course-I | Respective Engg Dept | 3 | 0 | 0 | 0 | 03 | 50 | 50 | 100 | 03 |
| 5 | ETC-I | 22ETC15x | Emerging Technology Course-I/ | Any Engg Dept | 3 | 0 | 0 | 0 | 03 | 50 | 50 | 100 | 03 |
| | OR | | | | | | | | | | | | |
| | PLC-I | 22PLC15x | Programming Language Course-I | | 2 | 0 | 2 | 0 | 03+02 | | | | |
| 6 | AEC | 22PWS16 | Professional Writing Skills in English | Humanities | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| 7 | HSMS | 22ICO17 | Indian Constitution | Humanities | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22KSK17<br>22KBK17 | Samskrutika Kannada/ Balake Kannada | | | | | | | | | | |
| 8 | AEC/SEC | 22SFH18 | Scientific Foundations for Health | Any Dept | 1 | 0 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22IDT18 | Innovation and Design Thinking | | 1 | 0 | 0 | 0 | 01 | | | | |
| | | | | **TOTAL** | | | | | | **400** | **400** | **800** | **20** |

**SDA**-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMS**-Humanity and Social Science and management Course, **SDC**- Skill Development Course, **CIE** -Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

***-22MATM11** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

**#-22CHEM12-** SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

**ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0 ) Questions from the practical component shall be included in SEE, however, there is no SEE for practical component.

**All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

| | |
|---|---|
| **Credit Definition:**<br>1-hour Lecture **(L)** per week=**1Credit**<br>2-2-hoursTutorial**(T)** per week=**1Credit**<br>3-hours Practical / Drawing (**P**) per week=**1Credit**<br>**2-**hous Skill Development Actives **(SDA)** per week = **1 Credit** | 04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practicalsessions<br>03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session<br>01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions |

**Student's Induction Program:** Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXURE-I of Induction Programs notification of the University published at the beginning of the 1st semester.

**AICTE Activity Points** to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

**(ESC-I) Engineering Science Courses-I**

| Code | Title | L | T | P |
|---|---|---|---|---|
| 22ESC141 | Introduction to Civil Engineering | 3 | 0 | 0 |
| 22ESC142 | Introduction to Electrical Engineering | 3 | 0 | 0 |
| 22ESC143 | Introduction to Electronics Engineering | 3 | 0 | 0 |
| 22ESC144 | Introduction to Mechanical Engineering | 3 | 0 | 0 |
| 22ESC145 | Introduction to C Programming | 2 | 0 | 2 |

**(ETC-I ) Emerging Technology Courses-I**

| Code | Title | L | T | P |
|---|---|---|---|---|
| 22ETC15A | Smart Materials and Systems | 3 | 0 | 0 |
| 22ETC15B | Green Buildings | 3 | 0 | 0 |
| 22ETC15C | Operation and Maintenance of Solar ElectricSystems | 3 | 0 | 0 |
| 22ETC15D | Introduction to Embedded System | 3 | 0 | 0 |
| 22ETC15E | Introduction to Nano Technology | 3 | 0 | 0 |
| 22ETC15F | Introduction to Drone Technology | 3 | 0 | 0 |
| 22ETC15G | Introduction to Sustainable Engineering | 3 | 0 | 0 |
| 22ETC15H | Renewable Energy Sources | 3 | 0 | 0 |
| 22ETC15I | Waste Management | 3 | 0 | 0 |
| 22ETC15J | Emerging Applications of Biotechnology | 3 | 0 | 0 |
| 22ETC15K | Introduction to Internet of Things (IOT) | 3 | 0 | 0 |
| 22ETC15L | Introduction to Cyber Security | 3 | 0 | 0 |

**(PLC-I) Programming Language Courses-I**

| Code | Title | L | T | P |
|---|---|---|---|---|
| 22PLC15A | Introduction to Web Programming | 2 | 0 | 2 |
| 22PLC15B | Introduction to Python Programming | 2 | 0 | 2 |
| 22PLC15C | Basics to JAVA programming | 2 | 0 | 2 |
| 22PLC15D | Introduction to C++ Programming | 2 | 0 | 2 |

- The student has to select one course from the ESC-I group.
- MES stream Students shall opt for any one of the courses from the ESC-I group **except, 22ESC144-Introduction to MechanicalEngineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

## II Semester
## Scheme of Teaching and Examination 2022-23
## Outcome-Based Education (OBE) and Choice Based Credit System(CBCS)
## (Effective from the academic year 2022-23)

**II Semester (Mechanical Engineering Stream. (For the students who have attended 1semster under Chemistry Group)**

| Sl.No | Course and CourseCode | | Course Title | TD/PSB | Teaching Hours/Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | SDA | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | *ASC(IC) | 22MATM21 | Mathematics for ME Streams-II | Maths | 3 | 0 | 2 | 0 | 03 | 50 | 50 | 100 | 04 |
| 2 | #ASC(IC) | 22PHYM22 | Physics for ME Streams | PHY | 2 | 2 | 2 | 0 | 03+02 | 50 | 50 | 100 | 04 |
| 3 | ESC | 22EME23 | Elements of Mechanical Engineering | Mechanical | If offered as theory course | | | | 03 | 50 | 50 | 100 | 03 |
| | | | | | 2 | 2 | 0 | 0 | | | | | |
| | | | | | If offered as Integrated course | | | | | | | | |
| | | | | | 2 | 0 | 2 | 0 | | | | | |
| 4 | ESC-II | 22ESC24x | Engineering Science Course-II | Respective Engg Dept | 3 | 0 | 0 | 0 | 03 | 50 | 50 | 100 | 03 |
| 5 | PLC-II | 22PLC25x | Programming Language Course-II | Any Engg Dept | 2 | 0 | 2 | 0 | 03+02 | 50 | 50 | 100 | 03 |
| | OR | | | | | | | | | | | | |
| | ETC-II | 22ETC25x | Emerging Technology Course-II | | 3 | 0 | 0 | 0 | 03 | | | | |
| 6 | AEC | 22ENG26 | Communicative English | Humanities | 0 | 2 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| 7 | HSMC | 22KSK27 22KBK27 | Samskrutika Kannada/ Balake Kannada | Humanities | 0 | 2 | 0 | 0 | 01 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22ICO27 | Indian Constitution | | | | | | | | | | |
| 8 | AEC/SDC | 22IDT28 | Innovation and Design Thinking | Any Dept | 0 | 0 | 2 | 0 | 02 | 50 | 50 | 100 | 01 |
| | | OR | | | | | | | | | | | |
| | | 22SFH28 | Scientific Foundations of Health | | 1 | 0 | 0 | 0 | 01 | | | | |
| | | | TOTAL | | | | | | | **400** | **400** | **800** | **20** |

**SDA**-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging

Technology Course, **AEC**- Ability Enhancement Course, **HSMS**-Humanity and Social Science and management Course, **SDC**- Skill Development Course, **CIE**–Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

***-22MATM21** Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

**#-22PHYM22** SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

**ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0 ),.

**All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

| **(ESC-II) Engineering Science Courses-II** | | | | | **(ETC-II) Emerging Technology Courses-II** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Code** | **Title** | **L** | **T** | **P** | **Code** | **Title** | **L** | **T** | **P** |
| 22ESC241 | Introduction to Civil Engineering | 3 | 0 | 0 | 22ETC25A | Smart materials and Systems | 3 | 0 | 0 |
| 22ESC242 | Introduction to Electrical Engineering | 3 | 0 | 0 | 22ETC25B | Green Buildings | 3 | 0 | 0 |
| 22ESC243 | Introduction to Electronics Engineering | 3 | 0 | 0 | 22ETC25C | Operation and Maintenance of Solar ElectricSystems | 3 | 0 | 0 |
| 22ESC244 | Introduction to Mechanical Engineering | 3 | 0 | 0 | 22ETC25D | Introduction to Embedded System | 3 | 0 | 0 |
| 22ESC245 | Introduction to C Programming | 2 | 0 | 2 | 22ETC25E | Introduction to Nano Technology | 3 | 0 | 0 |
| | | | | | 22ETC25F | Introduction to Drone Technology | 3 | 0 | 0 |
| | | | | | 22ETC25G | Introduction to Sustainable Engineering | 3 | 0 | 0 |
| | | | | | 22ETC25H | Renewable Energy Sources | 3 | 0 | 0 |
| | | | | | 22ETC25I | Waste Management | 3 | 0 | 0 |
| | | | | | 22ETC25J | Emerging Applications of Biotechnology | 3 | 0 | 0 |
| | | | | | 22ETC25K | Introduction to Internet of Things(IoT) | 3 | 0 | 0 |
| | | | | | 22ETC25L | Introduction to Cyber Security | 3 | 0 | 0 |
| | | | | | | | | | |
| **(PLC-II) Programming Language Courses-II** | | | | | | | | | |
| **Code** | **Title** | **L** | **T** | **P** | | | | | |
| 22PLC25A | Introduction to Web Programming | 2 | 0 | 2 | | | | | |
| 22PLC25B | Introduction to Python Programming | 2 | 0 | 2 | | | | | |
| 22PLC25C | Basics to JAVA programming | 2 | 0 | 2 | | | | | |
| 22PLC25D | Introduction to C++ Programming | 2 | 0 | 2 | | | | | |

- The student has to select one course from the ESC-II group.
- Mechanical Engineering stream Students shall opt for any one of the courses from the ESC-II group **except, 22ESC244-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

**Semester: I**

**(COMMON TO ALL BRANCHES)**

**Course Title: Computer Aided Engineering Drawing**

| | | | |
|---|---|---|---|
| **Course Code** | **22CAED13/23** | **CIE Marks** | **50** |
| **Teaching Hours/Week (L:T:P)** | **2:0:2** | **SEE Marks** | **50** |
| **Credits** | **03** | **Exam Hours** | **03** |
| **Total Number of Pedagogy Hours** | **40** | **Total Marks** | **100** |

**Pre-requisites:** Knowledge of basic geometrical shapes and instruments, measurement, unit conversions

**Course objectives:**

- Understand drawing as a communication mode
- Expose students to standards and conventions followed in preparation of engineering drawings
- Develop the ability of conveying the engineering information through drawings
- Acquire the knowledge of generating the orthographic views of lines, planes and solids.
- Understand the development of surfaces and isometric projections.
- To make them understand the relevance of engineering drawings to different engineering domains



**Module – 1**

**Introduction to Sketching**: Principles of Engineering Graphics and their significance, Drawing Instruments and their uses, BIS conventions, free hand sketching, Drawing sheets, Fundamentals of Scales, Introduction to Software (solid edge): Creation of 2D/3D environment, selection of drawing sheet size and scale, different commands, Dimensioning rules, Line Conventions.

**Introduction to Orthographic Projections,** planes of projection, reference line and conventions employed, First and Third angle of projection,

**Orthographic Projections of points** situated in all four quadrants.

**Orthographic Projection of straight lines** located in first quadrant with inclined to VP and HP**.** Problems on applications of straight lines without traces.

**Orthographic Projection of plane surfaces (First angle projection only)** Projection of regular plane surfaces- triangle, square, rectangle, pentagon, hexagon and circular laminae in simple positions resting on HP/ VP and inclined to HP/ VP using change of position method. (No problems on punched and composite plates).

**10 Hours**

**Module - 2**

**Orthographic Projection of Solids:** Introduction, Projections of right regular solids- prisms & pyramids (triangle, square, rectangle, pentagon and hexagon), cones, cubes (hexahedron) and tetrahedron, solids resting on HP ONLY

**10 Hours**

**Module – 3**

**Isometric Projection:** Introduction, Isometric scale, Isometric projection of- simple plane figures, individual solids and combination of two simple solids, Conversion of Isometric to orthographic views. Problems on applications of Isometric projection of simple Engineering components and conversion to orthographic projections (Mechanical, electrical and electronic components for CIE only).

**10 Hours**

**Module - 4**

**Development of Lateral Surfaces of Solids:** Development of lateral surfaces of right regular prisms, pyramids, cylinders and cones resting with base on HP only. Development of lateral surfaces of Sphere, frustums and truncation. Problems on applications of Development of lateral surfaces viz, funnel, tray, transition pieces, connecting two ducts

**10 Hours**

**Module – 5**

**Engineering Applications of Engineering Graphics:** Sketching and drawing simple Mechanisms, wiring and lighting diagrams, Basic building Drawings, Electronic Drawing- PCB Drawings. Introduction to Development of Computer Graphical Packages

**10 Hours**

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | |
|---|---|
| **CO1** | Understand the basics of Engineering graphics and to implement the principles of orthographic projections of points, lines and planes, |
| **CO2** | Analyze and draw the orthographic projections of solids. |
| **CO3** | Visualize three dimensional objects and to draw Isometric projection |
| **CO4** | Develop the lateral surfaces of solids |
| **CO5** | Visualize the components used in Engineering disciplines. |

## Assessment Details

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks) and that for SEE minimum passing marks is 35% of the maximum marks (18 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Examination / Evaluation (CIE):

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

**Final CIE Marks = (A) + (B)**

The Alternate Assessment Tools are Quiz, Assignments, Presentations, Open Book, Self E-Learning and Model Making.

### Semester End Examination (SEE):

The SEE question paper will be set for 100 marks and the marks will be proportionally reduced to 50.

1. The question paper will have 8 full questions from module-1 to module-4 as per below tabled weightage details.

| Module | Max. Marks Weightage | Evaluation Weightage in marks | |
|---|---|---|---|
| | | Computer display and print out (a) | Preparatory sketching (b) |
| Module 1 | 20 | 13 | 07 |
| Module 2 | 30 | 19 | 11 |
| Module 3 | 25 | 16 | 09 |
| Module 4 | 25 | 16 | 09 |
| **Total** | **100** | **64** | **36** |
| **Consideration of SEE Marks** | | **Total of (a) + (b) ÷ 2 = Final SEE marks** | |

2. The students will have to answer 4 full questions, selecting one full question from each module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Engineering Drawing: Plane and Solid Geometry | Bhatt, N.D | 53rd Edition, Charotar Publishing House Pvt. Limited, Gujarat | 2019 |
| 2 | Engineering Graphics | GopalakrishnaK.R | 32nd Edition, Subash Stores, Bangalore | 2005 |
| 3 | | | | |
| **Reference Books** | | | | |
| 1 | A Textbook of Engineering Drawing | Dhawan R. K | 3/e, S. Chand Publishing | 2019 |
| 2 | A Textbook of Engineering Graphics | Venugopal K., and Prabhuraj | New Age International Publishers | 2014 |
| 3 | Engineering Drawing | Parthasarathy N. S., Vela Murali, | Oxford University Press | 2015 |
| | | | | |

**E-Resources:**

1. https://www.youtube.com/watch?v=p62LPzFqGQw: Engineering Graphics and Design - Intro, IIT Delhi
2. https://youtu.be/26-RdMraMAY: Orthographic Projections, NPTEL
3. https://youtu.be/DW7dpKdxVrA: Orthographic Projections, NPTEL
4. https://www.youtube.com/watch?v=AoNIOxnxDO0&list=PLIhUrsYr8yHx7TVB51jN3HZVyW3R6RiBg
5. https://www.youtube.com/watch?v=7JpSSBVeSpI
6. https://www.youtube.com/watch?v=66R4esOwuAg&list=RDCMUCNQHebTzfRahptcsmuOVufg&index=4

**Semester: I/II**
**(ETC-I/II ) Emerging Technology Courses-I/II**
**(Mechanical Engineering stream)**
**Course Name: INTRODUCTION TO SUSTAINABLE ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | 22ETC15g/25g | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Credits | 03 | Exam Hours | 03 |
| Total Number of Pedagogy Hours | 40 | Total Marks | 100 |

**Pre-requisites:**

**Course Learning Objectives:**

- To familiarize the students to the area of sustainability and concepts of sustainability engineering.
- To enable students with an understanding of principles and frame work of sustainable engineering
- To provide students with an understanding of Life Cycle Assessment tool in sustainable engineering.
- To provide students with understanding of integration of sustainability with design. Teaching-Learning Process.

**Module – 1**

**Sustainable Development and Role of Engineers**: Introduction, Why and What is Sustainable Development, THE SDFs, Paris Agreement and Role of Engineering, Sustainable Development and the Engineering Profession, Key attributes of the Graduate Engineering
**Sustainable Engineering Concepts**: Key concepts – Factor 4 and Factor 10: Goals of sustainability,
System Thinking, Life Cycle Thinking and Circular Economy

**08 Hours**

**Module - 2**

**Sustainable Engineering and Concepts, Principles and Frame Work**: Green Economy and Low Carbon Economy, Eco Efficiency, Triple bottom Line, Guiding principles of sustainable engineering, Frameworks for sustainable Engineering.
**Tools for sustainability Assessment:** Environmental Management System, Environmental Auditing, Cleaner Production Assessment, Environmental Impact Assessment, Strategic Environmental

**08 Hours**

**Module – 3**

**Fundamentals of Life Cycle Assessment**
Why and What is LCA, LCA Goal and Scope, Life cycle inventory, Life Cycle Impact Assessment, Interpretation and presentation of Results, Iterative Nature of LCA, Methodological Choices, LCI Databases and LCA Softwares, Strength and Limitations of LCA.

**08 Hours**

**Module - 4**

**Environmental Life Cycle Costing, Social Life Cycle Sustainability Assessment**: Introduction, Environmental Life Cycle Costing, Social Life Cycle Assessment, Life Cycle Sustainability, LCA Applications in Engineering: Environmental Product Declarations and Product Category Rules, Carbon and Water Foot Printing, Energy systems, Buildings and the Built Environment**,** Chemical and Chemical Production Food and Agriculture

**Introduction to Environmental Economics**: Introduction – What Is Environmental Economics?, Valuing the Environment, Market-based Incentives (or Economic Instruments) for Sustainability

**08 Hours**

**Module – 5**

**Integrating Sustainability in Engineering Design:** Problems Solving in Engineering, conventional to Sustainable Engineering Design Process, Design for Life Guidelines and Strategies, Measuring Sustainability, Sustainable Design through sustainable procurement criteria, Case studies on sustainable Engineering Design Process – Sustainable Process Design, Sustainable Production Design.

**08 Hours**

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | |
|---|---|
| **CO1** | Elucidate the basics of sustainable development, sustainable engineering and its role in engineering |
| **CO2** | Application of Sustainable Engineering Concepts and Principles in Engineering |
| **CO3** | Apply the Principle, and methodology of Life Cycle Assessment Tool to engineering systems. |
| **CO4** | Outline the concept of integration methods of sustainability to Engineering Design |
| **CO5** | Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles |

**Assessment Details:**

**CIE:**

(Preferred pattern of the all test are similar to the SEE pattern, however; teacher may follow the CIE test pattern of other engineering courses)

Two assignments each of 10 Marks

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Three Unit Tests each of 20 Marks (duration 01 hour)

- First test at the end of 5th week of the semester

□Second test at the end of the 10th week of the semester
□Third test at the end of the 15th week of the semester
Two assignments each of 10 Marks
□First assignment at the end of 4th week of the semester
□Second assignment at the end of 9th week of the semester
Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours) t the end of the 13th week of the semester.
The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

**Semester End Examination(SEE):**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)
□The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
□The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

**Suggested Learning Resources:**

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| **Textbooks** | | | | |
| 1 | Introduction to Sustainability for Engineers | Toolseeram Ramjeawon | CRC Press | 1stEdn., 2020 |
| 2 | Sustainability Engineering: Concepts, Design and Case studies, | Prentice Hall | | 1stEdn, 2015 |
| 3 | System Analysis for sustainable Engineering: Theory and applications, , | Ni bin Chang | McGraw Hill Publications | 1stEdn., 2010 |
| **Reference Books** | | | | |
| 1 | Engineering for Sustainable development: Delivery a sustainable development goals, , | UNESCO | International Centre for Engineering Education, France, | 1stEdn., 2021 |
| 2 | Introduction to Sustainable Engineering | Rag. R.L. and Ramesh Lakshmi Dinachandran, | PHI Learning Pvt. Ltd. | 2ndEdn, 2016 |

## Web links and Video Lectures (e-Resources):

- VTU/EDUSAT/SWAYAM/NPTEL/MOOC.
- https://nptel.ac.in/courses/127105018
- https:/https://nptel.ac.in/courses/107103081/www.macfound.org
- https://unesdoc.unesco.org/
- https://unesdoc.unesco.org/ark:/48223/pf0000375644.locale=en
- https://engineeringforoneplanet.org/

**Semester: I/II**
**(ETC-I/II ) Emerging Technology Courses-I/II**
**(Mechanical Engineering stream)**
**Course Name: SMART MATERIALS AND SYSTEM**

| | | | |
|---|---|---|---|
| **Course Code** | 22ETC15a/25a | **CIE Marks** | 50 |
| **Teaching Hours/Week (L:T:P:S)** | 3:0:0:0 | **SEE Marks** | 50 |
| Total Hours of **Teaching-Learning** | 40 | **Total Marks** | 100 |
| **Credits** | 03 | **Exam Hours** | 03 |

**Pre-requisites: Knowledge of Basic mathematics and sciences.**

**Course objectives:**

1. To develop the students ability to learn emerging materials.
2. To make students to learn prefabricated building components
3. To understand the Actuators deployed in smart materials and shape memory alloys
4. To learn building information modeling for building design
5. To learn the concepts of 3-D printing

Teaching-Learning Process These is sampling Strategies; which teachers can use to accelerate the attainment of the various course outcomes.
1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Civil Engineering structures.
3. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle. 4. Encourage collaborative (Group) Learning in the class.
5. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking. 6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
10. Individual teachers can device innovative pedagogy to improve teaching-learning.

**Module – 1**

Emerging Materials Honey comb structure (Carbon composites), Nano-materials, engineered polymers, emerging sustainable by products (Fly ash and GGBS) and construction chemicals.

***Alternative Assessment Activities:***
*1. Demonstration of emerging materials properties.*
*2. Laboratory demonstration and Experiments on solid materials.*

**08 Hours**

**Module - 2**

Prefabricated/ Manufactured building components Definition, types of prefabricated/ manufactured building components and infrastructure, modular coordination, standardization, materials, systems, production, transportation and installation.

***Alternative Assessment Activities:***
*1. Demonstration of manufactured components*
*2.Video demonstration* prefabricated/ manufactured building

**08 Hours**

**Module – 3**

**Smart Materials**: Definition, Principles of Piezo-electricity, materials (Polymers and Ceramics), sensors (Piezo-electric sensor, strain gauge, shear sensor) smart composites, Overview **Magneto rheological Fluids**, **Magnetostrictive and shape memory Materials.**

***Alternative Assessment Activities:***
*1. Demonstration of* Piezo-electricity, materials
2. *Laboratory demonstration and Experiments*.

**08 Hours**

**Module - 4**

**Actuators, Piezoelectric Ceramic, Functional Gradient**
Introduction, Actuators, Piezoelectric Ceramics, Functionally Graded Materials.
**Electroceramics:** Introduction Electroceramics and Smart Systems Electromechanical Actuators, Actuator Materials

***Alternative Assessment Activities:***
1. *Demonstration of various smart materials.*
2. *Laboratory Demonstrations and Practical Experiments*

**08 Hours**

**Module – 5**

3-D Printing Importance, Historic development, advantages, common terminologies, classification, Process chain, 3 – D modeling, Data conversion and transmission, checking and preparation, Building, Post processing, Applications
***Alternative Assessment Activities:***

1. *Demonstration of 3D Models.*
2. *Laboratory Demonstrations and Practical Experiments*

**08 Hours**

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | |
|---|---|
| **CO1** | Make use emerging materials for construction |
| **CO2** | Decide the proper prefabricated building component |
| **CO3** | Use smart materials and methods in building construction |
| **CO4** | Use smart materials and shape memory alloys in building actuators |
| **CO5** | Prepare 3-D modeling and manufacture building component |

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation (CIE):**

Two Unit Tests each of 30 Marks (duration 01 hour) First test after the completion of 30-40 % of the syllabus• Second test after completion of 80-90% of the syllabus• One Improvement test before the closing of the academic term may be conducted if necessary. However best two tests out of three shall be taken into consideration

**Two assignments each of 20 Marks**

The teacher has to plan the assignments and get them completed by the students well before the closing of the term so that marks entry in the examination portal shall be done in time. Formative (Successive) Assessments include Assignments/Quizzes/Seminars/ Course projects/Field surveys/ Case studies/ Hands-on practice (experiments)/Group Discussions/ others. The Teachers shall choose the types of assignments depending on the requirement of the course and plan to attain the Cos and POs. (to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

**The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks**

**Semester End Examination (SEE):**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

**Suggested Learning Resources:**

**Text Books**

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| 1 | Essentials of Materials Science and Engineering, | Donald R. Askeland and Pradeep P. Fulay | Cengage Learning | 2009, |
| 2 | Smart Materials<br>Volume 1 And Volume 2 | I Schwartz, Mel M. | A Wiley-Interscience Publication **John Wiley & Sons, Inc.** The *Encyclopedia of Smart Materials is available Online at www.interscience.wiley.com/reference/esm* | ISBN 0-471-17780-6 (cloth : alk.paper) |
| 3 | Materials Science and Engineering | Callister Jr, W.D., Rethwisch, D.G., | Hoboken, NJ: Wiley | 10th Ed., 2018 |

**Reference Books**

| Sl. No. | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| 1 | Engineering Materials 1: An Introduction to Properties, Application and Design | Jones, D.R.H., and Ashby,M.F | Butterworth-Heinemann | 4th Ed., 2011 |
| 2 | Engineering Materials 2: An Introduction to Microstructure and Processing | . Jones, D.R.H., and Ashby,M.F | Butterworth-Heinemann | 4th Ed., 2012 |
| 3 | Physical Metallurgy Principles | Abbaschian, R., Abbaschian, L., Reed-Hill, R. E | Cengate Learning | 4th Ed., 2009 |

Web links and Video Lectures (e-Resources): YouTube Videos.

- Activity Based Learning (Suggested Activities in Class)/ Practical Based learning Site visits to understand the prefabricated building components.
- Visit to Smart material manufacturing facilities
- Visit to 3-D printing facility

**Semester: I/II**

**Engineering Science Course-I/II**

Course Name: **INTRODUCTION TO MECHANICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | 22ESC144/244 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 3 | Exam Hours | 03 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |

**Course Learning Objectives**

- To develop basic Knowledge on Mechanical Engineering, Fundamentals and Energy Sources.
- Understand the concept of different types of Machine tool operations and Modern Manufacturing Processes like CNC, 3D printing.
- To know the concept of IC engines and Future Mobility vehicles.
- To give exposure in the field of Engineering Materials and Manufacturing Processes Technology and its applications

To acquire a basic understanding role of Mechanical Engineering in the Robotics and Automation in industry.

**Teaching-Learning Process**

Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

- Adopt different types of teaching methods to develop the outcomes throughPowerPoint presentations and Video demonstrations or Simulations.
- Arrange visits to show the live working models other than laboratory topics.
- Adopt collaborative (Group Learning) Learning in the class.

**Module – 1**

**Introduction to Emerging Technologies**

**Introduction:** Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Energy Sources and Power Plants:** Review of energy sources; Construction and working of Hydel power plant, Thermal power plant, Solar power plant by photovoltaic (PV) cell, Wind power plant.

**08 Hours**

**Module - 2**

**Energy and I C Engine**

**Introduction to IC Engines**: Components and Working Principles, 4-Strokes Petrol and Diesel Engines, Application of IC Engines.

**Insight into Future Mobility;** Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of EVs and Hybrid vehicles

**08 Hours**

**Module – 3**

**Machine Tool Operations:**
Lathe: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, thread cutting, taper turning by swivelling the compound rest,
Drilling Machine: Working of simple drilling machine, drilling operations: drilling, boring, reaming, tapping, counter sinking, counter boring,
Milling Machine: Working, milling methods(Up milling down milling) operations milling: plane milling, end milling and slot milling.
**Introduction to Advanced Manufacturing Systems:** Introduction, components of CNC, advantages and applications of CNC,

**08 Hours**

## Module - 4

**Engineering Materials**: Types and applications of Ferrous & Nonferrous Metals, silica, ceramics, graphite, and polymer. Shape Memory Alloys.
**Joining Processes**: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding and types of flames.

**08 Hours**

## Module – 5

**Introduction to Mechatronics and Robotics:** open-loop and closed-loop mechatronic systems. Classification based on robotics configuration: polar cylindrical, Cartesian coordinate and spherical. Application, Advantages and disadvantages.
Automation in industry: Definition, types – Fixed, programmable and flexible automation , advantages and disadvantages.
**Evolution of technologies**; Introduction to Industrial revolution, Fourth industrial revolution (IR 4.0) Industrial IOT defination, merit, demerit and application.

**08 Hours**

**COURSE OUTCOMES:**
At the end of the course, the student will be able to:

| | |
|---|---|
| **CO1** | Explain the concepts of Role of Mechanical Engineering and Evolution of technologies |
| **CO2** | Explain the Working Principle of Energy sources and IC engines |
| **CO3** | Describe the Machine Tool Operations and advanced Manufacturing process. and various Metal Joining Processes |
| **CO4** | Describe the advanced Manufacturing process and EV vehicles. |
| **CO5** | Explain the Concepts of evolution technologies automation and Robotics |

Assessment Details

CIE:

| | Components | Number | Weightage | Max. Marks |
|---|---|---|---|---|
| (i) | Tests (A) | 3* | 60% | 30 |
| (ii) | Alternate Assessment Tools(AAT) (B) | 3-4 | 40% | 20 |
| | Total Marks | | | 50 |

Final CIE Marks = (A) + (B)

The following are the Alternate Assessment Tools and not limited to: Quiz, Assignments, Presentations, Paper Publications, MOOCs, Industrial Visits and Report Writing, Open Book, Self E-Learning with Certifications and other cooperative and problem based learning.

(Preferred pattern of the all test are similar to the SEE pattern, however; teacher may follow the CIE test pattern of other engineering courses)

Two assignments each of 10 Marks

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Three Unit Tests each of 20 Marks (duration 01 hour)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours) t the end of the 13th week of the semester.

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

**Semester End Examination(SEE):**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.

 The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.

 **There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.**

Suggested Learning Resources :

| SN | Title of the Book | Name of the Author/s | Name of the Publisher | Edition and Year |
|---|---|---|---|---|
| Textbooks | | | | |
| 1 | Engineering Design | John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson | Cengage learning | Second Edition, 2013 |
| 2 | The Design of Business | Roger Martin | Harvard Business Press | 2009 |
| 3 | Design Thinking: Understand – Improve – Apply | Hasso Plattner, Christoph Meinel and Larry Leifer | Springer | 2011. |
| Reference Books | | | | |
| 1 | Design Thinking for Strategic Innovation | Idris Mootee | John Wiley & Sons | Second Edition, 2011. |
| 2 | Engineering Design Process | Yousef Haik and Tamer M.Shahin | CengageLearning | 1st edition, 2012 |

E-Resources:

1. www.tutor2u.net/business/presentations/. /product lifecycle/default.html
2. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
3. www.bizfilings.com › Home › Marketing › Product Development
4. https://www.mindtools.com/brainstm.html
5. https://www.quicksprout.com/. /how-to-reverse-engineer-your-competitor
6. www.vertabelo.com/blog/documentation/reversengineering
7. \https://support.microsoft.com/en-us/kb/273814
8. https://support.google.com/docs/answer/179740?hl=en
9. https://www.youtube.com/watch?v=2mjSDIBaUlMthevirtualinstructor.com/foreshortening.html
10. https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf
11. https://dschool.stanford.edu/use-our-methods/
12. https://www.interaction-design.org/literature/article/stages-in-the-design-

thinking-process
13. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8.
14. https://www.nngroup.com/articles/design-thinking/
15. https://designthinkingforeducators.com/design-thinking/
16. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
http://dschool.stanford.edu/dgift/

**Semester: I**

**Engineering science course**

Course Name: **ELEMENTS OF MECHANICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Course Code | **22EME13/23** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 1:0:0 | SEE Marks | 50 |
| Credits | 3 | Exam Hours | 03 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |

Course Learning Objectives

- To develop basic Knowledge on Mechanical Engineering, Fundamentals and Energy Sources.
- Understand the concept of different types of Machine tool operations and Modern Manufacturing Processes like CNC, 3D printing.
- To know the concept of IC engines and Future Mobility vehicles.
- To give exposure in the field of Engineering Materials and Manufacturing Processes Technology and its applications

To acquire a basic understanding role of Mechanical Engineering in the Robotics and Automation in industry.

Teaching-Learning Process

Teaching-Learning Process

Adopt Problem Based Learning (PBL), which fosters students' Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Arrange visits to show the live working models other than laboratory topics.
- Adopt collaborative (Group Learning) Learning in the class.

**Module – 1**

**Introduction to Mechanical Engineering** (Overview only):
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Steam Formation and Application:**
Modes of heat transfer, Steam formation, Types of steam, Steam properties and applications of steam (simple numerical problems).

**Energy Sources and Power Plants:**
Basic working principles of Hydel power plant, Thermal power plant, nuclear power plant, Solar power plant, Tidal power plant and Wind power plant.

**08 Hours**

**Module - 2**

**Machine Tool Operations:**

**Lathe**: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, thread cutting, taper turning by swiveling the compound rest,

**Drilling Machine**: Working of simple drilling machine, drilling operations: drilling, boring, reaming, tapping, counter sinking, counter boring,

**Milling Machine**: Working methods of milling (up milling and Down milling), milling operations: plane milling, end milling and slot milling.

(No sketches of machine tools, sketches to be used only for explaining the operations).

**Introduction to Advanced Manufacturing Systems:** Introduction, components of CNC,advantages and applications of CNC, 3D printing.

**08 Hours**

**Module – 3**

**Introduction to IC Engines**: Components and working principles, 4-Stroke Petrol and Diesel engines, Application of IC Engines, performance of IC engines (Simple numerical).

**Introduction to Refrigeration and Air Conditioning**: Principle of refrigeration, Refrigerants, and their desirable properties. Working principle of VCR and VAR refrigeration system, working principle of room air conditioner & Applications of air Conditioners.

**08 Hours**

**Module - 4**

**Mechanical Power Transmission:**

Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, simple and compound gear trains (simple numerical problems)

Belt Drives: Introduction, Types of belt drives (Flat and V-Belt Drive)

**Joining Processes**: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding, (types of flames), TIG welding, MIG welding, Thermit welding, Laser beam welding and Electron beam welding processes

**08 Hours**

**Module – 5**

**Insight into future mobility technology;** Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of Electric Vehicles (EVs) and Hybrid vehicles.

**Introduction to Mechatronics and Robotics:** open-loop and closed-loop mechatronic systems. Robot anatomy, Applications of Robots in material handling, processing and assembly and inspection.

**08 Hours**

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

| | |
|---|---|
| **CO1** | Acquire a basic understanding about scope of mechanical engineering, fundamentals about steam and nonconventional energy sources. |
| **CO2** | Acquire a basic knowledge about conventional and advanced manufacturing processes. |
| **CO3** | Acquiring a basic understanding about IC engines, propulsive devices, and air-conditioner |
| **CO4** | Acquiring a basic knowledge about power transmission and joining processes. |
| **CO5** | Acquiring a basic insight into future mobility and mechatronics and robotics. |

Assessment Details:

CIE:

| | **Components** | **Number** | **Weightage** | **Max. Marks** |
|---|---|---|---|---|
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| 2 | The Design of Business | Roger Martin | Harvard Business Press | 2009 |
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| Reference Books | | | | |
| 1 | Design Thinking for Strategic Innovation | Idris Mootee | John Wiley & Sons | Second Edition, 2011. |
| 2 | Engineering Design Process | Yousef Haik and Tamer M. Shahin | Cengage Learning | 1st edition, 2012 |

E-Resources:

17. www.tutor2u.net/business/presentations/. /Product lifecycle/default.html
18. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
19. www.bizfilings.com › Home › Marketing › Product Development
20. https://www.mindtools.com/brainstm.html
21. https://www.quicksprout.com/. /How-to-reverse-engineer-your-competitor
22. www.vertabelo.com/blog/documentation/reversengineering
23. \https://support.microsoft.com/en-us/kb/273814
24. https://support.google.com/docs/answer/179740?hl=en
25. https://www.youtube.com/watch?v=2mjSDIBaUlMthevirtualinstructor.com/foreshortening.html
26. https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf
27. https://dschool.stanford.edu/use-our-methods/
28. https://www.interaction-design.org/literature/article/stages-in-the-design-thinking-process
29. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8.
30. https://www.nngroup.com/articles/design-thinking/
31. https://designthinkingforeducators.com/design-thinking/
32. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
http://dschool.stanford.edu/dgift/

**Ballari Institute of Technology and Management, Ballari**

**Department of Mechanical Engineering**

**Circular**

Date: 03.08.2024

In the view of Department 5th Board of Studies meeting, all the concerned faculty are here by informed to attend the meeting on 06.08.2023 at 10.30 am, HOD chamber.

HOD

Agenda:

1. To finalize the 21 Scheme and Syllabus of the VII and VIII semesters for the academic year 2024-25.
2. To finalize the 22 Scheme and Syllabus of the V and VI semesters for the academic year 2024-25.

| Sl. No | Name of the Faculty | Signature |
|---|---|---|
| 1 | Dr. Yadavalli Basavaraj | |
| 2 | Dr. Raghavendra Joshi | |
| 3 | Dr. V. Venkata Ramana | |
| 4 | Dr. B. Ganesh | |
| 5 | Dr. T. Lakshmi Kumari | |
| 6 | Dr. HM Anil Kumar | |
| 7 | Dr. Banakar Nagaraj | |
| 8 | Dr. Manjunatha. T.H | |
| 9 | Dr. Pavan Kumar B.K | |
| 10 | Dr. Shivaramakrishna. A | |
| 11 | Dr. Shekar. K | |
| 12 | Mr. B. Jaya Prakash | |
| 13 | Mr. Vishnu Prasad | |
| 14 | Mr. V. Srinivasulu | |
| 15 | Mr. K. Raghavendra | |
| 16 | Mr. Mohammed Fayaz | |
| 17 | Mr. Mayur Pawar | |
| 18 | Mr. Vijay Kumar. B.P | |
| 19 | Mr. Shiva Kumar. S.Y | |
| 20 | Mr. Manjunath. E | |
| 21 | Dr. Santhosh Janamatti | |
| 22 | Mr. Gavisiddappa. P | |
| 23 | Mr. Rajashekar. K | |
| 24 | Mr. Maharaja Gowda | |
| 25 | Mr. Raghavendra Karnool | |
| 26 | Mr. Raghavendra Shetty | |
| 27 | Mr. A. Taranath | |
| 28 | Mr. Kalyan Babu | |
| 29 | Mr. Venkatesh K.C | |
| 30 | Mr. Irayya Shikkerimath | |

Dean Academics :

# NEW BOARD OF STUDIES: MECHANICAL DEPARTMENT

6.8.24.

**DEPT. OF MECHANICAL ENGINEERING.**

| S. No. | Category | Nomination of the Committee | Name of the person |
|---|---|---|---|
| 1 | Head of the Dept. | Chairperson | **Dr. V. VENKATA RAMANA**<br>Professor & HOD – Mechanical Engg. |
| 2 | Faculty Members at different levels veering different specializations | Members | |
| 3 | Subject Experts from outside the College nominated by Academic Council ✓ | Members<br>1<br>9448286076 | **Mr. SUNIL KATARIA**<br>Executive Vice President,<br>JSW Steels Ltd., Toranagallu (Karnataka)<br>Email: sunil.kataria@jsw.in<br>Phone: 9448286076 |
| | ✓ | 2<br>9480694934 | **Dr. RAMESHWAR SAH,**<br>Associate Vice President,<br>R & D Department<br>JSW Steels Ltd., Toranagallu<br>Email ID: rameshwar.sah@jsw.in<br>Phone: 9480694934 |
| 4 | Expert from outside college, nominated by Vice-Chancellor<br>Virtual ✓ | Member<br>9449735400<br>8660223641 | **Dr. JAYANT KITTUR,**<br>Principal, KLS Gogte Institute of Technology – Belagavi<br>Phone: 9449735400<br>Email ID: jkk@git.edu. |
| 5 | Representative from industry / corporate sector / allied area relating to placement nominated by Academic Council<br>Virtual ✓ | Member<br>9632411799 | **Ganapathy Bhatta A.S.**<br>**Triveni Turbine Limited**<br>12-A Peenya Industrial Area,Bangalore 560058,Karnataka,India<br>Mob: +91 9632411799 \| Tel: 080 -22164000, Extn: 4062 \| Fax: 080-22164100<br>Website: www.triveniturbines.com |
| 6 | Postgraduate meritorious alumnus nominated by Principal Member | Member<br>9742529824 | **Mr. SUBODH KUMAR,**<br>Asst. Manager,<br>JSW Steels Ltd. – Toranagallu<br>Email: subodh066@gmail.com |
| 7 | Co-opted members<br>Virtual ✓ | Member<br>7338858702<br>9739367996 | **Mr. Vijeesh Kumar A**<br>vijeshkumar.a@harita.co.in<br>Harita TechServ Ltd.,<br>Bangalore, 9739367996 |
| | 1k<br>Virtual ✓ | 2<br>9900502818 | **Jaya Prakash A J**<br>Delivery Manager, Aerospace Vertical<br>Tata Consultancy Services<br>Cell:- +91 9900502818<br>Mailto: **jayaprakash.aj@tcs.com**<br>Website: http://www.tcs.com |

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT, BALLARI
## DEPARTMENT OF MECHANICAL ENGINEERING

Date: 06/08/2024

**PROCEEDINGS OF 5th BOARD OF STUDY MEETING HELD ON 06th AUGUST, 2024**

**Venue:** HOD Chamber, Ground Floor, C.V.RAMAN Block

**Time:** 10:30 AM

Mode: Hybrid

Platform: Teams

**Agenda:**

At the outset, the Chairman welcomed all the Honorable members for the 4th meeting of Board of Studies (UG) for discussing and finalizing the Scheme and Syllabus for B.E. 3rd year 21 scheme and 2nd year 22 scheme of Mechanical Engineering.

1. To Consider and approve the scheme and syllabus of **"V Semester"** for 3rd Year UG Course for the Academic Year 2024-25 under 22 Scheme.
2. To Consider and approve the scheme and syllabus of **"VI Semester"** for 3rd Year UG Course for the Academic Year 2024-25 under 22 Scheme.
3. To Consider and approve the scheme and syllabus of **"VII Semester"** for 4th Year UG Course for the Academic Year 2024-25 under 21 Scheme..
4. To Consider and approve the scheme and syllabus of **"VIII Semester"** for 4th Year UG Course for the Academic Year 2024-25 under 21 Scheme..
5. Any other matter with the permission of the chair
6. Vote of thanks.

**Suggestions:**

1. To Consider and approve the scheme and syllabus of **"5th Semester"** for 3rd Year UG Course for the Academic Year 2024-25 under 22 Scheme.

The suggestions given by the BOS panel are listed below,

| | |
|---|---|
| **Course Name** | **FLUID POWER ENGINEERING** |
| **Suggestions** | 1. Interchange of Modules 4,5 to Modules 2,3 |
| **Course Name** | **COMPOSITE MATERIALS** |
| **Suggestions** | 1. To use ASM Hand Book |
| **Course Name** | **SUPPLY CHAIN MANAGEMENT** |
| **Suggestions** | 1. To incorporate critical path method. |

2. To Consider and approve the scheme and syllabus of **"6th Semester"** for 3rd Year UG Course for the Academic Year 2024-25 under 22 Scheme..

**--NIL—**

3. To Consider and approve the scheme and syllabus of **"7th Semester"** for 4th Year UG Course for the Academic Year 2024-25 under 21 Scheme.

| | |
|---|---|
| **Course Name** | **COMPUTER INTEGRATED MANUFACTURING LABORATORY** |
| **Suggestions** | 1. Post processing of CNC programs for standard CNC control systems using FANUC only |
| **Course Name** | **Tribology** |
| **Suggestions** | 1. To cite different examples and case studies |
| **Course Name** | **Automatic Control Systems** |
| **Suggestions** | 1. To modify the chapter title for Polar plots as "Stability analysis using Polar and Nyquist plots" |
| **Course Name** | **Production Planning and Control** |
| **Suggestions** | 1. To include topic on Sub Contracting Principles or Vendor Management.<br>2. To modify the chapter tile in module 2 from method study to Time and Method Study |

4. To Consider and approve the scheme and syllabus of **"8th Semester"** for 4th Year UG Course for the Academic 2024-25 under 21 Scheme.

**--NIL—**

**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT, BALLARI**
**DEPARTMENT OF MECHANICAL ENGINEERING**

**General Suggestions:**

1. Articulation matrix for every subject should be added in the syllabus.
2. Check for typographical errors and alignment
3. Create opportunity for students for Self-Learning through text books
4. Activity based learning in theory and laboratory subjects.
5. Industry personal / Alumni to deliver talk on the management, finance and supply chain management subjects

**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT, BALLARI**
**DEPARTMENT OF MECHANICAL ENGINEERING**

## List of External and Internal Members of the BOS:

| S. No. | Name of the Member | Designation | Signature |
|---|---|---|---|
| 1 | Dr. V. Venkata Ramana | Chairman | |
| 2 | Dr. Yadavalli Basavaraj | Member | |
| 3 | Dr. Raghavendra Joshi | Member | |
| 4 | Dr. B. Ganesh | Member | |
| 5 | Dr. HM Anil Kumar | Member | AB |
| 6 | Mr. K. Raghavendra | Special Invitee | |
| 7 | Mr. Sunil Kataria | External Member | online |
| 8 | Dr. Jayant Kittur | External Member | online |
| 9 | Mr. Ganapathy Bhatta | External Member | online |
| 10 | Mr. Subodh Kumar | External Member | AB |
| 11 | Mr. Vijeesh Kumar | External Member | online |
| 12 | Dr. Rameshwar Sah | External Member | online |
| 13 | Department Faculty | Member | |
| 14 | Mr. B. Vishnu Prasad | Special Invitee | |

Date : 06-08-2024
Place : Ballari

YADAVALLI BASAVARAJ

Digitally signed by YADAVALLI BASAVARAJ
DN: cn=YADAVALLI BASAVARAJ c=IN o=Personal
Reason: I am the author of this document
Location:
Date: 2024-12-09 15:49+05:30