CO's Data (2017 SCHEME)

Slno	Subject code	Title	Course Outcomes
1	17MAT31	Engg. Mathematics - III	CO1: Find Fourier series of periodic functions. CO2:Evaluate Fourier transform, solve difference equations using Z-Transform. CO3:Apply statistical and numerical methods to fit the given data into appropriate curves and to solve algebraic, transcendental equations. CO4:Apply various numerical techniques to interpolate, evaluate definite integrals CO5:Use curl and divergence vector integration, to verify green's stroke's divergence theorems and to evaluate geodesics.
2	17EC32	Analog Eelectronics	CO1: Acquire knowledge of Working principle, characteristics and basic applications of BJT, construction, working principle of FET, Single stage, cascaded and feedback amplifier configurations, Frequency response characteristics of BJT and FET, Power amplifier classifications such as Class A, Class B and Voltage Regulators etc. CO2: Analyze small signal ac equivalent circuits using BJT and FET, low and high frequency response using BJT and FET, Feedback Circuits in terms of impedances and gain. CO3: Prove the performance of power amplifiers in terms of efficiency. CO4: Design oscillators with the help of feedback circuits. CO5: Interpret performance characteristics of transistors amplifiers and FETs.

3	17EC33	Digital Electronics	CO1: Apply the fundamental concepts, terminology of logic design and different Boolean postulates to solve the given problem. CO2:Apply the various simplification methods (K-map,Quin-MuClusky,MEV) to simplify the expression in a given problem. CO3:Apply the knowledge of basic combinational components to design the other combinational circuits. CO4:Analyse the concepts of sequential circuits and differentiate the types of sequential circuits. CO5:Design the various sequential circuits like registers, counters, and Mealy and Moore circuits.
4	17EC34	Network Analysis	CO1: Understand the basic concepts in analysing networks such as mesh,node,star-delta,source transformation & shifting and evaluate appropriate method to find voltage and current for any given network. CO2: State and prove network theorems such as superposition, millmans ,max power transfer…etc and demonstrate appropriate theorems to find the voltage or current in any given network. CO3: Differentiate between series and parallel resonance circuit and also demonstrate using frequency response for any circuit to find performance metrics like quality factor, bandwidth…etc. CO4: Define various 2 port network parameters Z,Y,h,T and establish relationshipbetween different parameters and formulate equations governing the behaviour of the network. CO5: List different standard inputs in analyzing the networks like step, ramp,impulse also analyze waveform synthesis using different inputs and apply the concepts of laplace transformation for a given network.

5	17EC35	Electronics Instrumentation	Co1: Describe analog instruments voltmeters and multimeters with error free readings Co2: Evaluate the functionality of digital instruments (such as DVM's, digital multi meter, digital frequency meter digital measurement of time) for measuring digital frequency, digital time, etc.. Co3: Apply the working principle of different oscilloscopes(delayed time base oscilloscope, analog ,sampling and digital storage oscilloscope) and signal generators(standard signal generators, laboratory type, square, pulse, frequency generators) for measuring amplitude, time and frequency Co4: Analyze the function of measuring instruments to calculate power, impedance, electric field strength, PH etc, and AC and DC bridges to measure resistance, capacitance and inductance Co5:Illustrate the functions of transducers (active and passive) with the help of bridge circuits
6	17EC36	Engineering Electromagnetics	CO1:Solve problems on Electric force, electric field intensity due to point, linear, volume charges by applying Coulombs Law and Guass Law CO2: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 CO3:Apply Poissons and Laplace equations for solving boundary value problems associated with electrostatics and magnetostatics. CO4:Analyze the applications of magnetostatics by applying biot-savart law, amphere's circuital law and derive the concepts of magnetic forces and materials to characterize the magnetic circuits. CO5: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.

7	17ECL37	Analog Electronics Lab	CO1: Design and test rectifiers, clipping circuits, clamping circuits and voltage regulators for given specifications. CO2: Design and test BJT/FET amplifiers to find gain and bandwidth for given specifications. CO3: Plot the characteristics of JFET/MOSFET devices and calculate the parameters namely drain resistance, mutual conductance and amplification factor. CO4: Design oscillator circuit using BJT/FET for specific frequency. CO5: Calculate the efficiency of Class B push pull power amplifier using BJT.
8	17ECL38	Digital Electronics Lab	CO1:Demonstrate the truth table of various expressions and combinational circuits using logic gates. CO2:Design ,test and evaluate combinational circuits such as Adder,Substractor and Code converters. 3:Design, test and evaluate combinational circuits such as Decoder, Encoder and Multiplexers. CO4:Construct sequential circuits such Flip flops , Shift registers and special type shift registers. CO5:Design synchronous and asynchronous counters, MOD N counter and Sequence generator.
9	17MAT41	Engg. Mathematics - IV	CO1:Apply various numerical methods to solve first order differential equation. CO2:Employ bessel's and legendre's differential equations to find the series solution. CO3:Apply the cauchy-riemann equations to find the analyticity of a function and determine poles and residues. CO4:To solve probabilistic of repeated nature and find the probability of joint probability distribution. CO5:To set the samples and use the knowledge of markov chains in attempting engineering problems for feasible random events.

10	17EC42	Microprocessor	CO1: Explain the History of evaluation of Microprocessors, Architecture of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU architecture CO2: Write 8086 Assembly level programs using the 8086 instruction set CO3: Write modular programs using procedures and macros. CO4: Write 8086 Stack and Interrupts programming CO5:Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors and INT 21 DOS interrupt
11	17EC43	Control Systems	CO1: Derive a mathematical model of a given system (physical, mechanical or electrical) represented through block diagram and signal flow graph CO2: Determine the behaviour of time response and steady state errors of I and II order systems for standard test input signals CO3: Analyze the stability of a system using numerical (Rouths -Harwitz criteria) and graphical (root locus)approach CO4: Evaluate and Correlate the stability of a system using time and frequency responses CO5: Model a control system in continuous and discrete time using state variable technique
12	17EC44	Singnals & Systems	CO1:Understand the mathematical description of continuous and discrete time signals and systems. CO2:Analyze the signals in time domain using convolution difference/differential equations CO3:Classify signals into different categories based on their properties. CO4:Analyze Linear Time Invariant (LTI) systems in time and transform domains. CO5:Build basics for understanding of courses such as signal processing, control system and communication.

13	17EC45	Principles of Communication Systems	CO1: Analyze and Compare modulation techniques such as AM, AM-DSBSC, SSB,VSB, FM and PM in time and Frequency domain. CO2: Demonstrate the generation and detection of AM and FM Wave. CO3:Derive functions like joint Probability, CDF, PDF, PSD,ConditionalProbability,moments,correlation for a given single or severalRandom Variables. CO4: Apply the concepts of Random Variables to Compare the performance of Analog Modulation techniques (AM, FM, DSB-SC) under a given Narrowband noisy signal environment. CO5:Realize the significance of pulse modulation Schemes (PAM, PPM, PWM) and line coding techniques with a digital communication context.
14	17EC46	Linear Integration Circuits	CO1: Acquire knowledge related to types of Opamp, basic concepts of Opamp, basic timer circuit of 555 Timer, operating principle of PLL, phase detectors/comparator, VCO and voltage regulators. CO2: Interpret the performance characteristics of practical Opamp considering various parameters like input output voltage range, CMRR, PSRR, Offset voltages and currents, Input/output Impedances, Slew rate and Frequency limitations. CO3: Solve problems related to Opamp characteristics and types of Opamp, PLL, VCO, ADC, DAC and 555 Timer. CO4: Analyze various applications of amplifier like DC and AC amplifiers, voltage and current sources, current amplifiers, instrumentation amplifiers, rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits, V-I, I-V Converters, log and antilog amplifiers, multiplier and dividers, triangular/rectangular wave generators, Phase shift and Wein bridge oscillators, Differentiator and integrator, crossing detectors, inverting Schmitt trigger circuits, monostable and astable multivibrators, first and second order low pass and high pass active filters, Voltage regulators, 555 Timer as astable and monostable multivibrators, PLL, ADC and DAC. CO5: Apply the knowledge gained about amplifiers in the design of various practical circuits like DC and AC amplifiers,

			voltage and current sources, current amplifiers, instrumentation amplifiers, rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits, V-I, I-V Converters, log and antilog amplifiers, multiplier and dividers, triangular/rectangular wave generators, Phase shift and Wein bridge oscillators, crossing detectors, inverting Schmitt trigger circuits, monostable and astable multivibrators, first and second order low pass and high pass active filters, Voltage regulators, 555 Timer as astable and monostable multivibrators, PLL, ADC and DAC.
15	17ECL47	Microprocessors Lab	CO1: Program a microprocessor to perform arithmetic, logical and data transfer applications CO2: Program a microprocessor to perform DOS interrupts, branch and loop operations CO3: Interface a microprocessor to various devices for simple applications. CO4: Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086. CO5: Utilize procedures and macros for modular programming.

16	17ECL48	Linear IC's & Communication Lab	CO1: Design Adder, Integrator, Differentiator circuits, Analog filters (2nd order LPF and HPF),OSCILLATORS (RC phase shift and Wein Bridge Oscillator), DAC and Instrumentation amplifier using op-amp µA 741 for a given design specification. CO2: Design and demonstrate the 555 timer operations in Astable & Monostable configurations to generate signals/pulses for a given requirements. CO3: Demonstrate the analog modulation schemes (AM,FM and PAM) to realize the importance of modulation in analog communication systems. CO4: Demonstrate DSBSC generation using balance modulator IC 1496/1596 and frequency synthesis using phase locked loop. CO5: Design RF mixer using BJT/FET and appreciate the role of RF mixer in Superheterodyne Receivers.
17	17ES51	Management and Entrepreneurship Development	CO1: To recall and identify the relevance of management concepts & its principles. CO2: To describe, discuss and relate management functions adopted within an organization. CO3: Realize the social responsibilities towards business and entrepreneurship CO4: To assess and modify different solution to small scale industries with the aid of financial institutions CO5: To demonstrate the Project Report, Appraisal and feasibility studies in the real world.

18	17EC52	Digital Signal Processing	CO1:Explain the frequency domain sampling and reconstruct discrete time signal. CO2:Compute DFT of a discrete time sequence using definition of DFT and properties. CO3:Evaluate Linear Convolution of Long input sequence and Impulse response using Overlap save and add methods. CO4:Develop FFT Algorithms to reduce the computation time of DFT CO5: Design Analog and Digital IIR Filters, FIR Filters using windowing techniques.Construct digital IIR and FIR filters in Direct form I, direct form II, Cascade, Parallel and Lattice Structures
19	17EC53	Verilog HDL	CO1: **Depict** the importance of HDL's and current trendsin HDL's,VLSI IC circuit design flow. CO2:**utilize** verilog constructs specified as per the IEEE 1364-2001 verilog standard to design digital circuits for the given specifications. CO3: **Differentiate** between top down and bottom -up digital design flow, Modules and Module Instances in Verilog CO4:**Verify** the functionality of verilog code for the specified digital logic circuit as per the given specifications of a combinational (or sequential) logic gate circuit by writing verilog code and test bench code for performing simulation. CO5: **Distinguish** and use constructs of three different modelling styles for writing verilog/VHDL code for the given specification.

20	17EC54	Information Theory & Coding	CO1: Examine mathematically the performance parameters of the digital communication system (information system) to solve simple engineering problems related to it. CO2: Analyze statistical modeling of independent and dependent information sources (Ex: Markov Source) for the given specifications. CO3: 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. CO4: Analyze the design aspects of communication channels (Continuous and Discrete Channel Modeling) in terms of channel capacity and entropy functions. CO5: 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.

21	17EC553	Operating System	CO1: Identify goals & functions of operating system to achieve effective resource utilization. Classify Operating system into Batch processing, Multiprogramming, Time sharing, Real time and Distributed classes of operating system. CO2: Apply preemptive and non preemptive scheduling policies using Round Robin, Least completion time and First Come First Serve, Shortest request next policies. CO3: Identify advantages and disadvantages of contiguous and non contiguous memory allocation using paging and segmentation and Apply page replacement policies like least recently and first in first out. CO4: Organize file system and input output control system. Interpret file, directory and Its types and structure respectively. CO5: Analyze message passing and mailboxes with the issues of its naming and delivery of message and Deadlock detection algorithm and prevention in resource allocation.
22	17EC562	Object Oriented Programming Using C++	CO1. Understand the fundamental concepts of C++ language and write C++ Programs structure to solve the problems. CO2. Understand the functions and apply object oriented technique CLASS with array, pointers and functions to design C++ program for applications. CO3. Integrate constuctors and destructors in the CLASS and apply operator overloading with constructors and destructors to implement processes to meet the desired specification of the project. CO4. Evaluate inheritence, virtual functions and polymerphin concepts in C++ program for the design of other software tools. CO5. Understand the file concepts and integrate all files with object oriented techniques to analyse the real world problems and design the project to solve it.

23	17ECL57	DSP Lab	**CO1: Demonstrate sampling theorem and evaluate Impulse response of a given system** **CO2: Compute Linear and Circular convolution of two given sequences CO3:Evaluate Auto correlation and cross correlation of given sequences and verify their properties** **CO4: Draw Magnitude and frequency spectrum by computing N point DFT of a sequence** **CO5: Design FIR and IIR Filters. Implement FIR and IIR Filters to meet the given specifications**
24	17ECL58	HDL Lab	CO1:**Apply** the Verilog HDL/VHDL constructs to model a list of combinational and sequential digital circuits in dataflow, behavioral or gate styles and simulate the same using Xilinx/Modelsim/Altera or any EDA tool. CO2: **Write** Synthesizable Verilog/VHDL codes to describe digital circuits and program FPGA/CPLD to experience the semi-custom VLSI design flow. CO3: **Demonstrate** the use of FPGA/CPLD to interface external peripherals such as stepper motor, LCD, DC Motors and validate the designs usingappropriate apparatus(likeoscilloscope) for the given specifications. CO4:**Demonstrate** the use of Verilog HDL/VHDL constructs to generate waveforms such as sine, triangular, square for the given specifications, and validate the same by interfacing DAC to FPGA/CPLD, and displaying on an oscilloscope.
25	17EC61	Digital Communication	CO1: Associate and apply the concepts of Bandpass sampling to well specified signals and channels CO2: Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels. CO3: Analyze symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels CO4:Apply the concepts of spread spectrum modulation techniques for secure communication.

26	17EC62	ARM Microcontroller & Embedded Systems	CO1: Understand the architectural features and instruction set of 32-bit microcontroller ARM Cortex M3. CO2: Program ARM Cortex M3 using the various instructions and C language for different applications. CO3: Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. CO4: Develop the hardware software co-design and firmware design approaches. CO5: Explain the need of real time operating system for embedded system applications.
27	17EC63	VLSI Design	CO1: Interpret and understand of MOS transistor theory, CMOS fabrication flow and technology scaling. CO2: Make use of the basic gates using the stick and layout diagrams with the knowledge of physical design aspects CO3: Identify and understanding the concept of Memory elements along with timing considerations with scaling fundamentals CO4: Demonstrate the basic knowledge of FPGA based system design and Interpret testing and testability issues in VLSI Design CO5: Analyze the CMOS subsystems and architectural issues with the design constraints

28	17EC64	Computer Communication Networks	CO1: Identify the networking components such as switches, hubs, routers etc. Explain the concepts of wireless and wired network structures. Identify the best models for media access control; calculate the performance parameters, such a delay, throughput, efficiency, shortest path, etc, associated with media access control protocols CO2: Provide efficient solutions to mitigate the issues associated with network layer and transport layer services such as flow control, addressing, congestion control, addressing, routing etc. For undergraduates, this is achieved by comparing and contrasting various features and limitations of several protocols Analyse the given real life problem in networking domain and solve that problem using analytical solutions or simulations CO3: Analyse the given real life problem in networking domain and solve that problem using analytical solutions or simulations
29	17EC653	Artificial Neural Networks	CO1: **Illustrate** the artificial neuron model and network through metaphorical biological neuron, analyze linear and non-linear separable problems using XOR problem and derive perceptron learning algorithm. CO2: **Interpret** Perceptron, Mean Squared Error and Gradient Descent algorithm Derive weight update equation for multilayer neural network using Back propagation algorithm and its practical considerations. CO3: **Analyze** the learning law in Support vector machine and the Radial bases function networks. CO4: **Demonstrate** the learning laws of self organizing feature map

30	17EC661	Data Structures Using C++	CO1. Identify the different types of datastructues ,linear and nonlinear and understand dynamic memory allocations,STL for the representation of datastructure. CO2. Demonstrate the datastructures arrays,stacks,matrix and their applications to solve problems. CO3. Analyse the queus and dictionary datastructure to implement them in applications. CO4. Analyse nonlinear datastructures,binary tress and its operations. CO5. Outline the importance of binary search ,trees with their operations and understand sorting techniques Heap datastructure.
31	17ECL67	Embedded Controller Lab	CO1: Understand the instruction set of 32-bit microcontroller ARM Cortex M3 and the software tool required for programming in Assembly and C language. CO2: Develop assembly language programs using ARM Cortex M3 for different applications CO3: Interface external devices and I/O with ARM Cortex M3 CO4:Develop C language programs and library functions for embedded system applications CO5:Develop Real Time Applications using Cortex M3
32	17ECL68	Computer Network Lab	CO1: Demonstrate the understanding of computer networking concepts through design, development and simulations CO2: Apply the knowledge acquired on the subject computer networking in solving problems such as physical layer errors, data flow problem at data link layer, congestion control at transport layer CO3: Create network scenarios using network simulators to study the behaviour of various networking protocols of TCP/IP protocol CO4: Study the performance of a Wireless Networks for different network conditions.

33	17EC71	Microwave & Antennas	CO1: Describe the use and advantages of microwave transmission CO2:Analyze various parameters related to microwave transmission lines and waveguides CO3:Identify microwave devices for several applications CO4:Analyze various antenna parameters necessary for building an RF system CO5:Recommend various antenna configurations according to the applications
34	17EC72	Digital Image Processing	CO1 : Illustrate image formation and the role of human visual system plays in perception of gray and color image data CO2 : Apply image processing enhancement techniques in both spatial and frequency(Fourier) domain CO3 : Distinguish restoration in presence of noise in doth spatial and frequency domain CO4 : Evaluate color models and morphological image processing CO5 : Analyze image segmentation, representation and boundary descriptors
35	17EC73	Power Electronics	CO1: Acquire the knowledge about structure, switching, control characteristics of various power devices and identify the various applications associated with it. CO2: Describe two transistor model of SCR and analyze various triggering circuits used for different semiconductor switches. CO3: Design and analyze various controlled rectifier circuits and learnt to select Suitable power electronic devices as per the requirements CO4: Design and analyze various ac voltage controller circuits and learnt to select Suitable power electronic devices as per the requirements. CO5: Formulate & analyze operation of dc choppers, inverters, different types of static switches and assess the performance

36	17EC743	Real Time Systems	CO1: Classify various Real time systems CO2: Explain the concepts of computer control, CO3: Explain the concepts of operating system and the suitable computer hardware requirements for real-time applications. CO4: Asses the software languages to meet Real time applications. CO5: Apply suitable methodologies to design and analyze Real-Time Systems.
37	17EC752	IOT &WSN	CO1: Identify the different IOT conceptual frameworks, architectural views and components in IOT network/M2M with respect to OSI Layers. CO2: Outline the design principles for connected devices, internet connectivity and cloud services/platform/concerns. CO3: Explore IDEs, open sources available for the analysis and development of IOT APIs and applications. CO4: Appreciate the need for privacy, security in IOT, and identify the relevant/essential issues related to IOT and WSN. CO5: Assess the applicability of communication protocols for IOT and Wireless Sensor Networks.
38	17ECL76	Advanced Communication Lab	CO1: Design & Demonstrate generation and detection of Digital Modulation Schemes and TDM. CO2:Determine the characteristics and response of Microwave devices and Optical wave guide CO3: Determine the characteristics of Micro strip antenna and compute the associated parameters . CO4: Measure Frequency, Wavelength, Power and Attenuation of Klystron Bench CO5: Simulate the Digital Modulation Scheme & line Codes with display of waveform.

39	17ECL77	VLSI Lab	CO1: Demonstrate the behavior of basic gates, buffer and transmission gate using Verilog coding. CO2: Realize the operation of flip-flops, adders, counters and SAR and verify the results. CO3 Design and draw Schematic, layout and verify LVS, DC and transient analysis of a CMOS Inverter. CO4 Design and draw Schematic, layout and verify DC, AC and transient analysis of CMOS differential amplifier, common source amplifier, common drain amplifier. CO5 Design and draw Schematic, layout and verify the simulation results of R-2R DAC, Op-Amp and SAR CMOS NAND and NOR gates.
40	17EC81	Wireless Cellular& LTE 4G Broadband	CO1. Appraise the historical evolution of cellular wireless technologies and identify the significance of different organizations/regulatory bodies across the world and the key technological enablers of LTE. CO2. Identify the essential wireless networking & communication technologies behind the LTE and related practical implementation challenges considering both uplink and downlink channels. CO3. Analyze air interface protocol, channel structure and related layer features for both downlink and uplink channels in the LTE standard.

41	17EC82	Fiber Optics & Networks	CO1:Classification and working of optical fiber with different modes of signal propagation. CO2:Describe the transmission characteristics and losses in optical fiber communication. transmission lines and waveguides CO3:Describe the construction and working principle of optical connectors, multiplexers and amplifiers. requirements for real-time applications. CO4:Describe the constructional features and the characteristics of optical sources and detectors. CO5:Illustrate the networking aspects of optical fiber and describe various standards associated with it.
42	17EC833	Radar Engineering	CO1: Demonstrate the understanding of the radar fundamentals, radar signals, Radar operating frequencies and its applications. CO2: Analyze the modified Radar range equation for the prediction of range performance and the detection of target signal in a noisy environment. CO3: Analyze the working principle of MTI and Doppler radar with its design considerations and relate the importance of microwave engineering and digital signal processing in the growth of RADAR technology. CO4: Compare Monopulse tracking and sequential lobing Radar tracking systems. CO5: Apply the fundamental knowledge of Antenna theory and communication systems for the parametric study of Radar subsystems, which includes Radar antenna, Radar Receiver, Duplexers, Receiver Protectors and Radar Displays.

	17EC84	Intrenship/Professional Practice	CO1: Design Project-related skills to develop a project CO2:Develop Employability enhancing activities CO3: Develop Professional behavior Onsight CO4:Develop their Communication skills
44	17ECP85	Project Work	CO1: Identify an Engineering problem and find appropirate solution for it. CO2: Design a project for current industrial standards CO3: implement project work in laboratory and industrial site CO4: Evaluate knowledge of contemporary issues and able to apply effectively for project management
45	17ECS86	Seminar	CO1: Students will better understand the role that effective presentations have in public/professional contexts and gain experience in formal/ informal presentation CO2:Students will demonstrate the ability to discern the assignment's intended audience and objectives and respond appropriately CO3: Students will be able to construct a paper consistent with expectations of the discipline, including an appropriate organization, style, voice and tone CO4: Students will be able to access information in a variety of ways appropriate to a discipline, including locating and using library collections and services and other search tools and databases and collaborate to work on intellectual projects.