

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code

22CS/CD62

Sixth Semester B.E. Degree Examinations, May/June 2026

MACHINE LEARNING

(CSE & CSE-DS)

Duration: 3 hrs

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions choosing ONE full Question from each Module.
2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBT:CO: PI)</u>
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Module-1

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|----|----|--|----|---------------|
| 1. | a. | Demonstrate the process of designing a checkers learning problem and outline the main steps involved in formulating the learning task. | 10 | (1 :1: 1.2.1) |
| | b. | Apply Find-S algorithm for the training data set Shown in Table-1 .
Find Most Specific Hypothesis, Number of Semantically Distinct Hypothesis and Syntactically Distinct Hypothesis. | 10 | (3 :3: 1.3.1) |

RID	Domain	Platform	Browser	Day	Screen	Country	Click
1	Edu	Mac	Net-3	Mon	XVGA	America	Yes
2	Com	Mac	Net Com	Tue	XVGA	America	Yes
3	Com	PC	IE	Sat	VGA	Europe	No
4	Org	Unix	Net-2	Wed	XVGA	America	Yes
5	Com	Unix	Net-2	Wed	XVGA	Europe	Yes

(OR)

- | | | | | |
|----|----|---|----|---------------|
| 2. | a. | Demonstrate how inductive bias is used in the Candidate Elimination algorithm during hypothesis space search. | 10 | (2 :2: 1.3.1) |
| | b. | Apply Candidate Elimination Algorithm for the training data set shown in Table-1 and find the consistent hypothesis. | 10 | (2 :2: 1.3.1) |

Module-2

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|----|----|--|----|---------------|
| 3. | a. | Construct Decision Tree for the training dataset provided in Table-2 | 10 | (3 :4: 1.3.1) |
|----|----|--|----|---------------|

RID	Color	Type	Doors	Tyres	Class
1	Red	SUV	Two	White wall	+
2	Blue	Minivan	Four	White wall	-
3	Green	Car	Four	White wall	-
4	Red	Minivan	Four	Black wall	-
5	Green	Car	Two	Black wall	+
6	Green	SUV	Four	Black wall	-
7	Blue	SUV	Two	Black wall	-
8	Blue	Car	Two	White wall	-
9	Red	SUV	Two	Black wall	-
10	Blue	Car	Four	Black wall	-
11	Green	SUV	Four	White wall	+
12	Red	Car	Two	Black wall	+
13	Green	SUV	Two	Black wall	-
14	Green	Minivan	Four	White wall	-

Note: (RBT: - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)

- b. Construct the decision tree to represent the following Boolean functions **10 (3 :4: 1.3.1)**
 (i) $A \wedge B$ (ii) $A \vee [B \wedge C]$ (iii) $A \text{ XOR } B$
 (iv) $A \wedge \neg B$ (v) $[A \wedge B] \vee [C \wedge D]$

(OR)

4. a. Describe the appropriate problems which are best suited for decision trees. What are Information gain and Entropy? How they are used to build the decision tree? **10 (3 :4: 1.3.1)**
 b. Outline the steps involved in ID3 algorithm with an example. **10 (3 :4: 1.3.1)**

Module-3

5. a. Apply the perceptron algorithm to design models for AND and OR gates. Use weights $W_0 = -0.8$, $W_1 = 0.5$, $W_2 = 0.5$ for AND gate and $W_0 = -0.3$, $W_1 = 0.5$, $W_2 = 0.5$ for OR gate. **10 (3 :4: 1.3.1)**
 b. Outline the steps involved in back propagation algorithm for training an artificial neural network. **10 (2 :2: 1.3.1)**

(OR)

6. a. Outline the steps involved in training a linear unit using gradient descent algorithm. **10 (2 :1: 1.3.1)**
 b. Consider the following training set and identify weight vector for one epoch. **10 (3 :4: 1.3.1)**

No.	Input Values	Desired Output values
1	$X_1 = (1, -2, 0, -1)$	$T_1 = -1$
2	$X_2 = (0, 1.5, 0.5, -1)$	$T_2 = -1$
3	$X_3 = (-1, 1, 0.5, -1)$	$T_3 = -1$

Learning constant is assumed to be 0.1

Initial weight vector is $W_0 = (1, -1, 0, 0.5)$

Module-4

7. a. There is a 60 % chance it will rain on Tuesday. If it rains on Tuesday, there is a 30 % chance it will rain on Wednesday. If it does not rain on Tuesday, there is a 50 % chance it will rain on Wednesday. What is the probability of rain on Wednesday? If it rained on Wednesday, what is the probability that it rained on Tuesday? **10 (3 :4: 1.3.1)**
 b. Apply Naive Bayes classifier for the following data set “stolen vehicles” and find the class label of the new instance X {Color = Red, Type = SUV, Origin = Domestic} **10 (3 :4: 1.3.1)**

Color	Type	Origin	Stolen
Red	Sports	Domestic	Yes
Red	Sports	Domestic	No
Red	Sports	Domestic	Yes
Yellow	Sports	Domestic	No
Yellow	Sports	Imported	Yes
Yellow	SUV	Imported	No
Yellow	SUV	Imported	Yes
Yellow	SUV	Domestic	No
Red	SUV	Imported	No
Red	Sports	Imported	Yes

(OR)

8. a. Apply K-NN algorithm in finding the class label of new instance Tomato by using the training data set provided. Assume K=3. 10 (3 :5: 1.3.1)

Ingredient	Sweet	Crunch	Food Type
Grapes	8	5	Fruit
Green Beans	3	7	Vegetables
Nuts	3	6	Protein
Orange	7	3	Fruit
Tomato (sweet=6, Crunch=4)			

- b. Summarize the architecture of Radial Basis Function Network (RBFN). 10 (2 :5: 1.3.1)

Module-5

9. a. Explain the working principle of K-Means algorithm. 10 (2 :5: 1.3.1)
- b. Compare and contrast the classification and clustering 10 (2 :5: 1.3.1)

(OR)

10. a. Describe the working of the DBSCAN clustering algorithm with the help of a suitable example. 10 (2 :5: 1.3.1)
- b. Explain various types of graph-based clustering approaches. 10 (2 :5: 1.3.1)

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