PVP 23

Code: 23IT3603

III B.Tech - II Semester - Regular Examinations – APRIL 2026

MACHINE LEARNING
(INFORMATION TECHNOLOGY)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	State any two real-world applications of machine learning.	L2	CO1
b)	Define feature engineering and write the need of it.	L2	CO1
c)	List any two non-metric similarity functions.	L2	CO1
d)	How do you compute accuracy in a classification model?	L2	CO1
e)	State Bayes' rule in probabilistic learning.	L2	CO1
f)	Mention two impurity measures used in decision tree algorithms.	L2	CO1
g)	What is the role of a perceptron in a classification task?	L2	CO1
h)	What is class-conditional independence in Naive Bayes?	L2	CO1
i)	Define divisive clustering.	L2	CO1
j)	What is the role of matrix factorization in clustering?	L2	CO1

PART – B

			BL	CO	Max. Marks
		UNIT-I			
2		Explain supervised, unsupervised and reinforcement learning paradigms with suitable examples.	L2	CO1	10 M
		OR			
3		Describe each stage of the machine learning process from data acquisition to prediction.	L2	CO1	10 M
		UNIT-II			
4	a)	Discuss different metrics used to evaluate classification models for the given confusion matrix: TP=80, FP=20, TN=10, FN=10. Calculate precision, recall and F1-score.	L3	CO2	5 M
	b)	Apply the K-Nearest Neighbor algorithm with $k = 3$ to classify the test point (3,3) using the dataset {(1,1) - A, (2,2) - A, (4,4) - B, (5,5) - B}.	L3	CO2	5 M
		OR			
5	a)	Apply KNN regression to a sample dataset and compute the predicted value for a new point.	L3	CO2	5 M
	b)	Explain different proximity and distance measures used in nearest neighbor algorithms with suitable examples.	L3	CO2	5 M
		UNIT-III			
6	a)	Explain how decision trees perform classification using impurity measures such as entropy.	L2	CO1	3 M

<table>
<tr><td></td><td>b)</td><td>Analyse the following data set and apply the Naïve Bayes classifier to predict “if a new customer (Age Group = Young, Income = Medium) will buy the product or not”.
<table>
<tr><th>Customer</th><th>Age Group</th><th>Income</th><th>Buys Product?</th></tr>
<tr><td>1</td><td>Young</td><td>High</td><td>No</td></tr>
<tr><td>2</td><td>Young</td><td>Medium</td><td>Yes</td></tr>
<tr><td>3</td><td>Middle-Aged</td><td>High</td><td>Yes</td></tr>
<tr><td>4</td><td>Senior</td><td>Low</td><td>No</td></tr>
<tr><td>5</td><td>Young</td><td>Low</td><td>Yes</td></tr>
<tr><td>6</td><td>Middle-Aged</td><td>Medium</td><td>Yes</td></tr>
<tr><td>7</td><td>Senior</td><td>Medium</td><td>No</td></tr>
<tr><td>8</td><td>Middle-Aged</td><td>High</td><td>Yes</td></tr>
</table></td><td>L4</td><td>CO4</td><td>7 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>7</td><td>a)</td><td>Explain the bias-variance trade-off in decision tree models with suitable examples.</td><td>L2</td><td>CO1</td><td>5 M</td></tr>
<tr><td></td><td>b)</td><td>Discuss the working principle of the Naïve Bayes Classifier, its assumptions, advantages, limitations and provide an example scenario where it performs well compared to other classification algorithms.</td><td>L4</td><td>CO4</td><td>5 M</td></tr>
<tr><td colspan="6">UNIT-IV</td></tr>
<tr><td>8</td><td>a)</td><td>Apply perceptron learning algorithm to AND and OR Boolean functions.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td></td><td>b)</td><td>Explain the architecture of a Multi-Layer Perceptron and describe how back propagation updates weights during training.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>9</td><td>a)</td><td>Illustrate the working of expectation and maximization based clustering.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td></td><td>b)</td><td>Explain and Differentiate between single-layer perceptron and Multilayer Perceptron.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
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<table>
<tr><td colspan="6">UNIT-V</td></tr>
<tr><td rowspan="2">10</td><td>a)</td><td>Perform one iteration of K-Means clustering for points {(2,2), (3,3), (7,7), (8,8)} assuming initial centroids (2,2) and (7,7).</td><td>L3</td><td>CO3</td><td>5 M</td></tr>
<tr><td>b)</td><td>Explain spectral clustering and describe how it differs from traditional clustering methods.</td><td>L3</td><td>CO3</td><td>5 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">11</td><td>a)</td><td>Using K-Means clustering on the following dataset with K = 2, initialize the centroids as (15, 39) and (20, 81). Perform one iteration by computing the Euclidean distance of each data point from the centroids and assigning each point to the nearest centroid. Show the new cluster assignments after this iteration.
<table>
<tr><th>CID</th><th>Income</th><th>Score</th></tr>
<tr><td>1</td><td>15</td><td>39</td></tr>
<tr><td>2</td><td>20</td><td>81</td></tr>
<tr><td>3</td><td>30</td><td>20</td></tr>
<tr><td>4</td><td>35</td><td>60</td></tr>
<tr><td>5</td><td>40</td><td>65</td></tr>
</table></td><td>L3</td><td>CO3</td><td>5 M</td></tr>
<tr><td>b)</td><td>Illustrate the working of agglomerative hierarchical clustering using a small dataset and show cluster merging at each step.</td><td>L3</td><td>CO3</td><td>5 M</td></tr>
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