Code No.: R22CS602PC

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CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–II–Semester End Examinations (Supply) - December- 2025
MACHINE LEARNING
(Common for CSE, IT, CSC, CSD, CSM)

[Time: 3 Hours] **[Max. Marks: 60]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 10 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(10 Marks)**

1.	a)	Interpret handwriting recognition as well posed learning problem.	[1M]
	b)	Consider the hypothesis h1 = <Sunny, ?, ?, ?, ?, Change>. Justify the consistency of h1 over the instance (or example) d1=< Sunny, Warm, Normal, Strong, Warm, Same>, whose target label is "Yes".	[1M]
	c)	Differentiate between a perceptron and a multi-layer perceptron.	[1M]
	d)	State Support Vector Machine principles.	[1M]
	e)	Define Entropy.	[1M]
	f)	List any two algorithms which use bagging and boosting.	[1M]
	g)	Perform single-point crossover at position 3 between binary strings: A = 110101, B = 001110	[1M]
	h)	LDA is best suited for which type of problem: classification or regression.	[1M]]
	i)	Write state update rule in Q-learning.	[1M]
	j)	Differentiate between sampling with and without replacement.	[1M]

PART-B **(50 Marks)**

2. Describe the Linear Regression algorithm. Derive the formula for the weights of a linear regression model. [10M]

OR

3. Find the version space for the given data using candidate elimination algorithm. [10M]

Origin	*Manufacturer*	*Color*	*Decade*	*Type*	*Example Type*
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chrysler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive

4. Derive back propagation rule for both hidden and output layers [10M]

OR

5. Explain the role of basis functions in interpolation. Describe how splines are used as basis functions for smooth interpolation of data points. [10M]

6. Explain the concepts of bagging and boosting in ensemble learning. Compare their mechanisms and use cases. [10M]

OR

7. Construct decision tree for the following data. [10M]

Id	Outlook	Temperature	Humidity	Wind	Play Tennis?
1	Sunny	Hot	High	Weak	0
2	Sunny	Hot	High	Strong	0
3	Overcast	Hot	High	Weak	1
4	Rainy	Mild	High	Weak	1
5	Rainy	Cool	Normal	Weak	1
6	Rainy	Cool	Normal	Strong	0
7	Overcast	Cool	Normal	Strong	1
8	Sunny	Mild	High	Weak	0

8. Describe the Linear Discriminant analysis (LDA) algorithm. How does LDA preserve local neighborhood information while reducing dimensions? [10M]

OR

9. Explain the concept of Principal Component Analysis (PCA) to reduce the dataset from 2D to 1D. [10M]

10. Compare and contrast Reinforcement Learning with Supervised and Unsupervised Learning. [10M]

OR

11. Describe the importance of the Proposal Distribution in Markov Chain Monte Carlo (MCMC) algorithms. [10M]

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