BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO/2025)

CLASS: BTECH **SEMESTER : V**
BRANCH: AIML **SESSION : MO/2025**

SUBJECT: AI301 SUPERVISED LEARNING

TIME: 03 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Demonstrate the solution of a linear regression problem using gradient descent and derive the Widrow-Hoff learning rule.	[5]	1	4
Q.1(b)	Describe the Naïve Bayes' classifier technique.	[5]	1	3
Q.2(a)	Explain the Multilayer perceptron learning algorithm, deriving the backpropagation error components for output layer and hidden layer neurons.	[5]	2	2
Q.2(b)	Given the following, and Step activation function for output nodes: $W^{[1]} = \begin{bmatrix} 1 & 0 \\ 0.1 & 1 \\ 0.4 & -0.1 \\ -0.1 & -0.1 \end{bmatrix} \quad X = \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$ Draw the neuron architecture and compute the outputs. Recompute the outputs for the following change in bias weight: $w_{02} = -2$	[3+2]	2	3
Q.3(a)	Describe the role of Lagrange multipliers in solving the SVM problem.	[5]	3	4
Q.3(b)	What is the significance of Kernels in SVM? Explain with examples.	[5]	3	3
Q.4(a)	Discuss overfitting and pruning in decision trees. Illustrate with suitable examples.	[5]	4	3
Q.4(b)	Demonstrate the Information gain attribute selection measure by choosing the best split on feature F1 for the given table. Show the computations for all the splits.	[5]	4	3

F1	F2	Label
18	74	A
16	90	B
20	78	B
14	50	A
18	77	A

Q.5(a)	Explain the bagging algorithm for ensemble learning with an example.	[5]	5	3
Q.5(b)	How does the boosting algorithm perform ensemble learning? Explain in context of AdaBoost algorithm.	[5]	5	4

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