Name:

Enrolment No:

UPES

End Semester Examination, May 2025

Course: Applied Machine Learning **Semester: II**

Program: MCA + MTech (CSE) **Time : 03 hrs.**

Course Code: CSAI-7019 **Max. Marks: 100**

Instructions: Attempt all questions, Usage of scientific calculator is allowed.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1.	Consider a Multi-Layer Perceptron with the following architecture: • Input layer: 8 neurons. • Hidden layer: 12 neurons. • Output layer: 3 neurons. Calculate the total number of parameters used in this MLP.	**4**	**CO2**
Q 2.	State the difference between bagging and boosting ensemble techniques.	**4**	**CO3**
Q 3.	Discuss the differences between hard clustering and soft clustering. Provide examples of clustering algorithms that fall into each category.	**4**	**CO5**
Q 4.	What is Soft-max function? Discuss its significance in soft-max regression.	**4**	**CO4**
Q 5.	State the difference between bagging and boosting ensemble techniques.	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6.	For the given data, compute two clusters using K-means algorithm for clustering where initial clusters centers are (1.0,1.0) and (5.0, 7.0). Execute for two iterations. Record Number | A | B R1 | 1.0 | 1.0 R2 | 1.5 | 2.0 R3 | 3.0 | 4.0 R4 | 5.0 | 7.0 R5 | 3.5 | 5.0 R6 | 4.5 | 5.0 R7 | 3.5 | 4.5		**10**	**CO5**
Q 7.	Write short note : **(any two)** (2*5=10) a) Explain the concept of Multi-Layer Perceptron (MLP). b) Explain the activation functions for machine learning with the help of understanding mathematical notations. c) Explain the concept of Support Vector Machine (SVM)		**10**	**CO4**
Q 8.	Explain the different features of scaling techniques. Use suitable examples to explain the feature scaling techniques.		**10**	**CO3**
Q 9.	a) A student obtained the mean and standard deviation of 100 observations as 40 and 5.1 respectively. It was later discovered that he had wrongly copied down		**10**	**CO2** **CO3**

	an observation 50 instead of 40. Calculate the correct mean and standard deviation. **(5 marks)** b) Explain the basic principles of Principal Component Analysis (PCA) and how it is used for dimensionality reduction. **(5 marks)** **OR** c) Explain the role of cost function in linear regression model with the help of a suitable example. **(5 marks)** d) Mention and explain the categories of missing data with respect to machine learning. **(5 marks)**		
SECTION-C **(2Qx20M=40 Marks)**			
Q 10.	<table><tr><td>Age</td><td>Competition</td><td>Type</td><td>Profit</td></tr><tr><td>Old</td><td>Yes</td><td>S/W</td><td>Down</td></tr><tr><td>Old</td><td>No</td><td>S/W</td><td>Down</td></tr><tr><td>Old</td><td>No</td><td>H/W</td><td>Down</td></tr><tr><td>Mid</td><td>Yes</td><td>S/W</td><td>Down</td></tr><tr><td>Mid</td><td>Yes</td><td>H/W</td><td>Down</td></tr><tr><td>Mid</td><td>No</td><td>H/W</td><td>Up</td></tr><tr><td>Mid</td><td>No</td><td>S/W</td><td>Up</td></tr><tr><td>New</td><td>Yes</td><td>S/W</td><td>Up</td></tr><tr><td>New</td><td>No</td><td>H/W</td><td>Up</td></tr><tr><td>New</td><td>No</td><td>S/W</td><td>Up</td></tr></table>Follow the above table and calculate Information Gain of the target attribute, Entropy of the remaining attributes, find out the Gain and make the Decision Tree of the above structure.	**20**	**CO5**
Q 11.	a) Explain the following : **(any four)** **(4*5= 20)** (i) Differentiate between OLTP and OLAP. (ii) Linear and Logistic Regression. (iii) Overfitting and Underfitting. (iv) Batch Gradient and Stochastic Gradient optimizers. (v) Cross Validation Technique. (vi) F1 Score. **OR** b) Discuss Confusion matrix. Explain the basis of Model Evaluation and Selection. Suppose there are two models M1 and M2. For M1 : TP = 6954, FN=46, FP=412, and TN=2588 For M2: TP = 6800, FN= 134, FP=566, and TN=2500. Calculate accuracy, recall, specificity, sensitivity, and Z-Score. And Among M1 and M2 which one is more preferable model. **(10 marks)** c) Discuss the role of feature selection in Multiple Linear Regression and what metrics would you use to evaluate a linear regression model and a logistic regression model**.** **(10 marks)**	**20**	**CO3** **CO4** **CO5**