UPES

End Semester Examination, May 2025

Course: Machine Learning   Semester: IV
Program: B.Tech. (Electronics and Computer Engineering)   Time   : 03 hrs.
Course Code: MECH 2077   Max. Marks: 100

Instructions: Attempt all the questions. All questions are compulsory. The scientific calculator is allowed.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the term "*Production System*" in AI and list its key components.	4	CO1
Q 2	Explain batch gradient descent and stochastic gradient descent.	4	CO2
Q 3	Explain the linear kernel and Radial Basis Function (RBF) kernel in SVM. Highlight their main differences.	4	CO3
Q 4	Explain K-means clustering algorithm with an example.	4	CO4
Q 5	Explain Artificial Neural Networks (ANN) with an example.	4	CO5

SECTION B
(4Qx10M= 40 Marks)

Q 6	Define Artificial Intelligence (AI) and explain its goal of emulating human cognitive processes. Briefly outline the historical evolution of AI.	10	CO1
Q 7	Define machine learning (ML) and explain its primary goal. Compare supervised, unsupervised, and reinforcement learning by providing one example and key characteristics for each.	10	CO2
Q 8	Using the provided dataset on study hours (X) and test scores (Y):	10	CO3

Study hours (X)	1	2	3	4	5
Test Scores (Y)	50	55	65	70	80

Calculate the slope and intercept of the simple linear regression line. Predict the test score for a student who studied for **6** hours using your regression equation.

Q 9	Given the following four data points in 2D space: **A**: (1, 2), **B**: (2, 1), **C**: (4, 5), and **D**: (5, 4). (*i*) Perform hierarchical clustering using the **single linkage** method. (*ii*) Draw the dendrogram representing the hierarchical clustering process. (*iii*) Based on the dendrogram, how many clusters would you form if the cutoff height is 3?	10	CO4

SECTION-C
(2Qx20M=40 Marks)

Q 10 A	Apply the K-NN algorithm (with K=3) to predict whether a patient is diabetic or not based on the following dataset. The new patient has BMI = 43.6, Age = 40:	10	CO3

BMI	33.6	26.6	23.4	43.1	35.3	35.9	36.7	25.7	23.3	31
Age	50	30	40	67	23	67	45	46	29	56
Sugar	1	0	0	0	1	1	1	0	0	1

Q 10 B	Explain the working of neural networks, discuss their various types, and outline their advantages and disadvantages.	10	CO5
Q 11	Define Principal Component Analysis (PCA). Explain all the steps involved in PCA with an appropriate example. **OR** Define the decision tree algorithm. List down the attribute selection measures used by the Iterative Dichotomiser 3 (ID3) algorithm to construct a decision tree. Write the advantages and disadvantages of the decision trees.	20	CO4