

B.E. INFORMATION TECHNOLOGY FOURTH YEAR FIRST SEMESTER – 2025**Subject: Machine Learning****Full Marks - 100****Time - 3 Hours****CO1 (25 Marks)**

1. State and describe briefly the different types of machine learning algorithms. [6]
2. Differentiate between classification and regression. [5]
3. How is K-nearest neighbor (KNN) algorithm different from K-Means clustering? [5]
4. Justify the necessity for dimensionality reduction in the context of machine learning. [3]
5. Compare overfitting and underfitting using the concept of Bias and Variance. Give examples [6]

CO2 (25 Marks)

6. Use the K-Means algorithm to cluster the following 8 points into 3 clusters: $A_1 = (2, 10)$, $A_2 = (2, 5)$, $A_3 = (8, 4)$, $A_4 = (5, 8)$, $A_5 = (7, 5)$, $A_6 = (6, 4)$, $A_7 = (1, 2)$, $A_8 = (4, 9)$. Suppose that the initial seeds (centers of each cluster) are A_1 , A_4 and A_7 . Run the K-Means algorithm for 2 epochs. At the end of each epoch show:
 - i. The new clusters (i.e. the points belonging to each cluster); [5]
 - ii. The centers of the new clusters; [5]
 - iii. Draw a 10 by 10 space with all the 8 points and show the clusters after the second epoch and the new centroids. [5]
7. Consider the points as follows:

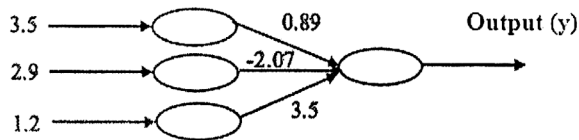
	X	Y
P1	0.07	0.83
P2	0.85	0.14
P3	0.66	0.89
P4	0.49	0.64
P5	0.80	0.46

Apply Agglomerative hierarchical clustering technique (using the **Single** and **Complete** linkage methods and Euclidean distance) for determining the clusters. Draw the Dendrogram for both the methods. [6+4]

[Turn over

CO3 (15 Marks)

8. Explain the concept of Artificial Neural Network (ANN) with a suitable diagram? [9]
9. Compute output of the following neuron (assume $bias = 0.5$) if activation function is: [6]
 - i. Sigmoid
 - ii. Tanh
 - iii. ReLU



CO4 (20 Marks)

10. Draw and explain the architecture of convolutional neural network. [10]
11. What is the difference between a Feed-forward Neural Network and Recurrent Neural Network? [5]
12. Explain the architecture of Autoencoder? [5]

CO5 (15 Marks)

13. Elaborate on the various issues like control learning, control policies, Q-learning and convergence in reinforcement learning. Give a suitable application. [10]
14. What are the types of reinforcement learning? [5]

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CO1: Explain concepts of Machine Learning paradigm.

CO2: Comprehend mathematical analysis and various theories of machine learning approaches.

CO3: Choose and experiment different types of ANN and to get an insight of when to apply a particular approach or solving problems.

CO4: Express and illustrate Deep Learning frameworks and its applications.

CO5: Describe and illustrate methods of Reinforcement Learning.
