Autonomous

PCS010526EB-1

Reg No.: _____ Name : _____

Jyothi Engineering College(Autonomous)

PhD Coursework Examination, May 2026

25PCST211 - INTRODUCTION TO MACHINE LEARNING

CSE, Ph.D

Total Mark: 60 **Total Time: 2hr 30min**

100 MARKS

PART A

Answer All Questions

1. Distinguish between overfitting and underfitting. How can they affect model generalisation? Explain the role of cross-validation in addressing these issues. CO1 (5)
2. What is logistic regression and how is it different from linear regression? Explain the role of the sigmoid function in binary classification. CO2 (5)
3. Discuss the issues involved in decision tree learning. Explain how information gain is used in the ID3 algorithm. CO1 (5)
4. Explain the DBSCAN clustering algorithm. How does it identify core points, border points, and noise? CO4 (5)
5. Explain the basic elements of a Hidden Markov Model (HMM). List any two real-world applications of HMM. CO1 (5)

PART B

Answer Any Five Question(s)

6. Distinguish between supervised learning, unsupervised learning, and reinforcement learning with suitable examples. CO1 (7)
7. Explain the bias-variance tradeoff in machine learning. Describe k-fold cross-validation and how it helps in model selection. CO2 (7)
8. Derive the least squares solution for linear regression. Explain gradient descent and its role in minimising the cost function. CO3 (7)
9. Explain the feed-forward neural network architecture with a suitable diagram. Describe the back-propagation algorithm and the weight update rule. CO1 (7)
10. Explain the Support Vector Machine (SVM) for binary classification. Discuss the concept of the optimal separating hyperplane and the role of kernel functions. CO2 (7)
11. Explain the Naive Bayes classifier. Apply Gaussian Naive Bayes to the following dataset to classify a new sample: given class priors P(C1)=0.6, P(C2)=0.4, mean and variance of each feature for both classes. CO3 (7)

12. Illustrate Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) for a 2-dimensional dataset. Compare their objectives and use cases. CO4 (7)

****