Paper ID : 250240

Roll No: | | | | | | | | | | | | | |

MCA
(SEM IV) THEORY EXAMINATION 2024-25
PATTERN RECOGNITION

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q No.	Question	CO	Level
a.	Define pattern recognition and give a real-world example.		
b.	What is the role of the covariance matrix in multivariate analysis?		
c.	State Bayes' theorem and its significance in pattern classification.		
d.	What are discriminant functions in statistical pattern recognition?		
e.	What is Maximum Likelihood Estimation (MLE)?		
f.	Explain the significance of Principal Component Analysis (PCA) in pattern recognition.		
g.	Define Parzen window density estimation.		
h.	What is the role of K-Nearest Neighbour (K-NN) in pattern recognition?		
i.	Briefly state any two clustering techniques used in pattern recognition.		
j.	Explain the purpose of cluster validation in unsupervised learning.		

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

Q No.	Question	CO	Level
a.	Describe the basic design principles of a pattern recognition system.		
b.	Define Bayesian decision theory and explain its basic decision rules.		
c.	What is Bayesian parameter estimation? Describe its basic principle.		
d.	What is density estimation in pattern recognition? Explain its types.		
e.	Define clustering and explain its significance in pattern recognition.		

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

Q No.	Question	CO	Level
a.	Explain the multivariate normal distribution and its significance in pattern recognition.		
b.	Discuss how the chi-squared test is applied for feature selection in a pattern recognition problem.		

4. Attempt any *one* part of the following: **10 x 1 = 10**

Q No.	Question	CO	Level
a.	Explain discriminant functions and how they determine decision boundaries.		
b.	Using a suitable example, discuss how Bayesian classification is applied to a two-class problem with given priors and likelihoods.		

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5. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Explain the Expectation-Maximization (EM) algorithm for incomplete data problems using suitable examples.		
b.	Illustrate through suitable examples how Principal Component Analysis (PCA) is used to reduce a dataset from 3D to 2D.		

6. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Explain the working principle of the K-Nearest Neighbour (K-NN) rule and its advantages using a suitable example.		
b.	Discuss how to apply Parzen window density estimation to a 1D dataset with three sample points.		

7. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Using suitable examples and diagrams, explain the working of the K-means clustering algorithm with its limitations.		
b.	Analyze the different linkage criteria used in agglomerative hierarchical clustering and explain how the choice of linkage affects the shape and structure of the resulting clusters. Support your analysis with suitable examples.		