Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U5211

M.E. DEGREE EXAMINATION, NOV 2025

Professional Elective

21PCM511– PATTERN RECOGNITION AND APPLICATION

(Regulations 2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) In an art class 75 students, 11 are left handed. Compute whether this class fit the prevailing theory that 12% of people are left-handed? CO2-App (20)

Or

(b) A manager of a sports club keeps information concerning the main sport in which members participate and their ages. To test whether there is a relationship between the age of a member and his or her choice of sport, 643 members of the sports club are randomly selected. Conduct a test of independence. CO2-App (20)

Sport	18-25	26-30	31-40	41-50
Racquet ball	42	58	30	46
Tennis	58	76	38	65
Swimming	72	60	65	33

2. (a) Explain in detail about Bayesian parameter learning and it applications in various aspects. CO1-U (20)

Or

(b) Illustrate statistical Pattern recognition with an example. CO1-U (20)

3. (a) What is principal component? How principal component analysis used for dimension reduction in pattern recognition. CO1-U (20)

Or

(b) Discuss in detail Maximum –Likelihood estimation and its usage in Pattern recognition? CO1-U (20)

4. (a) You have a simple ANN with: CO3-App (20)

- One hidden layer with 2 neurons
- Input vector: x=[1,0]
- Initial weights:
  - Input to hidden: w1=[0.5,−0.4],w2=[0.3,0.8]
  - Hidden to output: wout=[0.7,−0.6]

Task:

- Perform a forward pass and compute the output (use sigmoid activation).
- Suppose target output is 1.

Compute the error and apply one iteration of back propagation using a learning rate of 0.1.

Or

(b) Given a linear discriminant function: CO3-App (20)

$g(x)=w^Tx+b$, where

$w=\begin{bmatrix}2\\-1\end{bmatrix}$, $b=-3$

- Classify the point $x=[4,2]^T$ using this function.
- Calculate the gradient of g(x) at this point and explain what it represents geometrically.
- Plot the decision boundary.

5. (a) Assume a dataset where two clusters are linearly separable but without labels. You apply clustering followed by training a Support Vector Machine (SVM) using pseudo-labels. Also obtain results without clustering and analyze which gives better results and give the reasons? CO4-Ana (20)

Or

(b) You are given the following dataset with two-dimensional points: CO4-Ana (20)

Class A: (1, 2), (2, 1), (1.5, 1.5)

Class B: (4, 5), (5, 4), (4.5, 4.5)

(a) Apply the K-Means algorithm with K=2 by initializing centroids at (1,2) and (4,5). Perform one full iteration (assignment + update step).

(b) Apply the value of K as 3,4,5 and obtain the clustering results and analyze the performance with increased K value.