Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CSE)/SEM-8/CS-801F/2012

2012

PATTERN RECOGNITION

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Objective Type Questions)

1. Answer *all* questions in brief : 10 × 1 = 10

i) Define Pattern Recognition.

ii) What is meant by an N-dimensional pattern space Ω_x ?

iii) What are likelihood functions ?

iv) What is clustering ?

v) What is feature vector ?

vi) What do you mean by feature extractor ?

vii) What is feature selection ?

viii) What are the three learning paradigms in pattern recognition ?

ix) What are the approaches to pattern recognition ?

x) What do you mean by linear discriminate function ?

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain Linear Discriminate Analysis (LDA).

3. Why is it necessary to establish some rules in the PR problem ? What is the way of representing rules ? 3 + 2

4. Characterize the decision function when each class is characterized by several prototypes.

5. What are the different measures of similarity of the assignment of patterns for the domain of a particular cluster centre ?

6. Explain maximum distance algorithm.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Describe the basic steps involved in the design of pattern recognition system.

b) What is the maximum likelihood (ML) estimation ? Show that if the likelihood function is univariate Gaussian with unknowns the mean μ as well as variance σ^2 , then ML estimates are given by

$$\mu = \frac{1}{N} \sum_{k=1}^{N} X_k \text{ and } \sigma^2 = \frac{1}{N} (X_k - \mu)^2 ,$$

where X_k is the kth pattern and N is the total number of training patterns.

c) Compare parametric and non-parametric techniques.

6 + 5 + 4

8. a) What is Bayesian classifier ? Prove that it is an optimal classifier.

b) In a two class problem with single feature X the pdfs are Gaussian with variance $\sigma^2 = \frac{1}{2}$ for both classes and mean value 0 and I respectively. If $P (\omega_1) = P (\omega_2) = \frac{1}{2}$, compute the threshold value X_0 for minimum error probability. 4 + 5 + 6

9. a) Define performance index in cluster-seeking problem. 3

   b) Describe the isodata algorithm to categorize points in different clusters. 12

10. a) What is the form and property of decision functions when the classes are pair-wise separable ? 5

    b) Explain the classification in XOR problem using Linear Discriminant Analysis (LDA). 10

11. a) Describe the decision-making process in Pattern Recognition which may be treated as a statistical game played by the classifier against nature. 9

    b) What is the use of causal network ? Explain with an example. 6