Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech (CSE)/SEM-8/CS-801F/2010

2010
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 :   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 ?

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vii) What is feature selection ?

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

ix) What are the approaches to pattern recognition ?
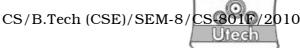
x) What do you mean by linear discriminant function ?

GROUP – B
(Short Answer Type Questions)
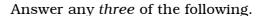Answer any *three* of the following. 3 × 5 = 15

2. Explain Linear Discriminant 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) Define the k-NN rule when the patterns of both the classes ω_1 and ω_2 are equally likely to occur.

   b) What is the form of property of decision function when the classes are pair-wise separable ? 8 + 7

8. a) Define performance index in cluster-seeking problem.

   b) Describe the isodata algorithm to categorize points in different clusters. 3 + 12

9. 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

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

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

11. a) Write down the advantage of fuzzy-c means algorithm over k-means algorithm.

b) Can you indicate the shortcomings of fuzzy-c means algorithm ?

c) Explain k-means algorithm in detail. 3 + 4 + 8