



Name :

Roll No. :

Invigilator's Signature :

**CS/M.TECH(ECE)/SEM-2/MCE-205B/2011
2011**

IMAGE PROCESSING & 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.

Answer question no. 1 and any four from the rest.

$$7 \times 2 = 14$$

1.
 - i) Write down the discriminant function equation.
 - ii) What is unsupervised data ?
 - iii) $D_g(p, q) = \max(|x - s|, |y - t|)$, $S = \{q \mid D_g(p, q) \leq r\}$ forms a sequence—justify the statement.
 - iv) $X_s(t) = X(t) \text{comb}(t)(t, \Delta t_s)$ $X_s(w) = X(w) * f(\text{comb}(t, \Delta t_s))$ – justify the statement.
 - v) Discuss any two thresholding techniques used in image segmentation.
 - vi) Illustrate the thresholding techniques with proper example.
 - vii) What is pattern recognition ?



2.
 - i) Explain city block distance and chess board distance.
 - ii) What is the Skeletonisation ?
 - iii) How do you obtain Skeleton from an image ?
 - iv) What is distance transformation ? 6 + 2 + 4 + 2
3.
 - i) Explain the block diagram of Digital image processing.
 - ii) What is the need of image digitization ?
 - iii) Prove that $N_4(p) \cap N_D(p) = \phi$
 - iv) Explain the adjacency of pixel.
 - v) Explain sampling theorem using Dirac-Delta function. 5 + 2 + 2 + 2 + 3
4.
 - i) When we will use the Least Square Methods to design a classifier ?
 - ii) Describe the expression for new weight vector using Least Square Method.
 - iii) In a 2D space we have four points $(-1, 0)$ $(0, 1)$ belongs to W_1 . and points $(0, -1)$ $(1, 0)$ belongs to W_2 . Design a linear classifier using the Perceptron Algorithm in its reward and punishment form. The parameter p is set equal to one and initial weight vector is chosen as $W(0) = [0 \ 0]^T$.
 - iv) What do you mean by "Reward & Punishment method". 1 + 6 + 6 + 1
5. Write short notes :
 - i) Image mining/retrieval techniques.
 - ii) Clustering algorithms.
 - iii) Basic technique for Eigen Face Generation/Recognition.



6. i) What is Pattern Recognition ?
 ii) Explain the different application of Pattern Recognition ?
 iii) What are the different types of Pattern Recognition ?
 iv) Class W_1 consists of the 2D vectors $[0.2, 0.7]^T$, $[0.3, 0.3]^T$ and class W_2 of $[0.4, 0.6]^T$, $[0.6, 0.2]^T$. Design the classifier using Sum of Error Squares Method.
7. a) Consider the following 5×5 image represented by the gray level values of the pixel.

3	4	2	1	1
1	6	7	0	0
1	5	<u>5</u>	2	3
2	6	1	2	3
6	7	1	0	4

Apply the image smoothing filters as per following specification assuming $f(2, 2)$ as the centre pixel underlined in the image where 3×3 the mask is to be applied

- i) Mean filter
 ii) Minimum filter
 iii) Maximum Filter
 iv) Median Filter
 v) Weighted filter with mask as

1	2	4
3	2	1
0	1	4

$$2 + 2 + 2 + 2 + 2$$



b) Apply suitable contrast stretching methods on the following image as per given specifications

- i) For $V = [0, 1]$, Compute D_4 , D_8 and D_m distance between points p and q .
- ii) For $V = [1, 2]$, Compute D_8 distance between p and q , Comment on your computation.

3	1	1	1	1(q)
1	1	2	0	2
1	2	2	0	1
1	2	0	1	1
(p)1	0	1	0	2
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