00910

M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)
M.Sc. (MACS)

Term-End Examination

December, 2012

MMTE-003 : PATTERN RECOGNITION AND IMAGE PROCESSING

Time : 2 hours *Maximum Marks : 50*

(Weightage : 50%)

Note : *Attempt any **five** questions. All questions carry **equal** marks. Use of Calculator is **not** allowed.*

1. (a) Explain the following giving one example of each. **4**

(i) Gamma correction

(ii) Wiener filter.

(b) Perform linear convolution between the image matrices h(m, n) and $x(m, n)$ given as **6**

$$x(m, n) = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \quad h(m, n) = (3, 4, 5)$$

2. (a) Discuss any three pixels adjacency in an image, with one example, of each. 3

(b) Obtain H_3 Hadamard transform given 7

$$H_1 = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

Also, obtain the sequency of H_3.

3. (a) For a given orthogonal matrix 6

$$I = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}, \text{ and imge } X = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

obtain the transformed image and the inverse transformation to get the original image X.

(b) Discuss any two models for noise with their mean and variances. Give one example of each model. 4

4. Explain the steps involved in Huffman's source coding technique. Hence, obtain the Huffman code for the word 'COMMITTEE'. 10

5. (a) Obtain the output of the median filter if the image is given by the matrix. [2 3 8 4 2] and the window $W = [-1\ 0\ 1]$ 5

(b) Differentiate between image enhancement and image restoration techniques. 5

6. (a) The following pattern classes have Gaussian probability density functions. 5

$$w_1 = \left\{ (0, 0)^T, (2, 0)^T, (2, 2)^T, (0, 2)^T \right\}$$

and $$w_2 = \left\{ (4, 4)^T, (6, 4)^T, (6, 6)^T, (4, 6)^T \right\}$$

(i) Assuming that $p(w_1) = p(w_2) = \frac{1}{2}$ obtain the equation of the Bayes decision boundary between these two classes.

(ii) Sketch the boundary.

(b) Derive the expression of optimal Global thresholding which produces minimum average segmentation error. 5