



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.Tech (CSE)/SEM-3/CS-1111/2010-11**

**2010-11**

**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 any *five* questions.

5 × 14 = 70

1. a) Mention similarities and differences between analog and digital images. 2
- b) Explain the process of capturing an image using an ordinary photographic camera ( use analytical relations ). 8
- c) Mention different reasons for insertion of additive noise in an image during the capturing process. 4
2. a) Define the following types of noise : 5
  - i) Additive noise
  - ii) Multiplicative noise
  - iii) Gaussian noise
  - iv) Impulsive noise
  - v) Salt and pepper noise.



- b) Write down a procedure to generate impulsive noise. 5

- c) Consider the following image ( $f$ ) : 4

$$f = \begin{bmatrix} 2.3 & 1.1 & 9.3 & 8.4 \\ 3.2 & 2.1 & 8.2 & 9.1 \\ 9.1 & 7.2 & 0.8 & 2.0 \\ 8.2 & 8.1 & 1.2 & 0.9 \end{bmatrix}$$

It is told that differences from the nearest integer are the additive noise for each pixel. Generate the error matrix ( $e$ ) and the denoised matrix ( $d$ ). Hence compute the signal-to-noise ratio for the given image ( $f$ ).

3. a) Write down the significance of Fourier Transformation in Image processing. 4

- b) In frequency domain, what are represented by low and high frequency components of the transform coefficients ? 4

- c) Explain separability, translation and periodicity properties of a 2D Fourier transformation. 6



4. a) Write down the different uses of histogram in Image processing. 2

b) Derive the relations for Histogram Equalization and write down the corresponding algorithm. 8

c) Consider the following histogram of an 8-level image : 4

Gray level $i$	0	1	2	3	4	5	6	7
No. of pixel $n_i$	13	10	12	9	8	7	5	0

i) What is the size of the square image ?

ii) What is the average appearance of the image :  
darker or lighter ?

5. a) Write down the different relations of linear and non-linear histogram stretching. 4

b) Consider the histogram given in Question 4(c).

Linearly stretch the histogram for the new gray scale range [ 0 — 15 ]. 10



6. a) Why do we require edge detection from an image ? 2
- b) What are the objectives of edge detection ? What are its potential problems ? 4
- c) Develop  $3 \times 3$  operators for First and Second order edge detection using gray level differences. How can you perform image sharpening using Laplacian edge detector ? 8
7. a) What do you mean by pattern recognition ? Mention some of its potential applications. 4
- b) Describe the roles of perceptron and MLP for pattern classification with clear diagram and analytical relations. 8
- c) Write down a perceptron learning algorithm. 2
8. Write short notes on any *two* of the following : 7 + 7
- a) Clustering and  $k$ -means algorithm
- b) Hierarchical clustering algorithm
- c) Genetic algorithm and pattern recognition.