	Utech
Name :	
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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.  $5 \times 14 = 70$ 

- a) Mention similarities and differences between analog and digital images.
  - Explain the process of capturing an image using an ordinary photographic camera ( use analytical relations).
  - Mention different reasons for insertion of additive noise
    in an image during the capturing process.
- 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.

40048 [ Turn over

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



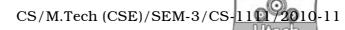
- b) Write down a procedure to generate impulsive noise.
- c) Consider the following image (f):

$$f = \begin{bmatrix} 2 \cdot 3 & 1 \cdot 1 & 9 \cdot 3 & 8 \cdot 4 \\ 3 \cdot 2 & 2 \cdot 1 & 8 \cdot 2 & 9 \cdot 1 \\ 9 \cdot 1 & 7 \cdot 2 & 0 \cdot 8 & 2 \cdot 0 \\ 8 \cdot 2 & 8 \cdot 1 & 1 \cdot 2 & 0 \cdot 9 \end{bmatrix}$$

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.
  - b) In frequency domain, what are represented by low and high frequency components of the transform coefficients?
  - c) Explain separability, translation and periodicity properties of a 2D Fourier transformation. 6

40048 2



- 4. a) Write down the different uses of histogram in Image processing.
  - b) Derive the relations for Histogram Equalization and write down the corresponding algorithm.
  - 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.
  - b) Consider the histogram given in Question 4(c).

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

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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.	Wri	te 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.

40048 4