Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MCA/SEM-5/MCA-E-501B/2009-10

2009

IMAGE PROCESSING

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
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) A digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are called

   a) dot b) pixel

   c) point d) none of these.

   ii) The total amount of energy that flows from the light source and it is usually measured in watts (*W*) is called

   a) Radiance b) Luminance

   c) Reflectance d) none of these.

iii) Digitizing the coordinate values of an image is called

a) Quantization b) Sampling

c) Segmentation d) Compression.

iv) The ratio of the vertical points to horizonatal points necessary to produce equal-length lines in both directions on the screen is called

a) Resolution b) Quantization

c) Aspects ratio d) none of these.

v) An image of 1024 ∝ 1024 pixels, in which the gray scale is [0, 255]. How much storage space is required if the image is not compressed ?

a) 1024 ∝ 1024 ∝ 256 bits

b) 1024 ∝ 1024 ∝ 255 bits

c) 1024 ∝ 1024 ∝ 8 bits

d) none of these.

vi) Which connectivity arise multiple path connection ?

a) 4-connectivity b) 8-connectivity

c) *m*-connectivity d) none of these.

vii) The eye does not respond with equal sensitivity to all visual information, which information has less importance than other information in normal visual processing is called

a) Inter-pixel redundancy

b) Coding redundancy

c) Psychovisual redundancy

d) none of these.

viii) In which image, histogram covers broad range of the gray scale ?

a) Dark image b) Bright image

c) Low contrast image d) High contrast image.

ix) Replaces the value of a pixel by the median of the gray levels in the neighborhood of that pixel is called

a) Mean filter b) Median filter

c) Max filter d) Min filter.

x) Which filter is used to reduce pepper noise ?

a) Max filter

b) Min filter

c) Harmonic mean filter

d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What is gray image and what is binary image ? What do you mean by gray level and gray scale ? 2 + 3

3. What are the differences between image enhancement and restoration ? What is the equation for getting a negative image ? 3 + 2

4. What is the difference between lossy and lossless image compression. What do you mean by data redundancy, relative data redundancy and compression ratio ? 2 + 3

5. What is Salt and Pepper noise ? What is Quad-tree ? 3 + 2

6. What are mean and median filters ? Compare their performance. 2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What is image averaging ?

   b) Discuss Histogram characteristics for dark, bright, low contrast and high contrast images.

   c) Consider the following image :

5	4	12	5
5	5	12	5
5	12	12	11
5	5	11	5

   where gray level range is zero to fifteen. Equalize the above image histogram. Show the histogram before and after equalization. 3 + 4 + 8

8. a) Explain Huffman coding in image compression.

b) Find the entropy of an image of size 4 × 4 where gray level values are given as

10	10	15	15
15	15	50	50
15	25	25	15
15	15	50	50

c) Explain DCT. 4 + 6 + 5

9. a) Explain the following filters :

i) Arithmetic mean filter

ii) Geometric mean filter

iii) Harmonic mean filter.

b) "An intensity histogram of an image gives some useful clues about the shape of the objects in the image." Can you agree with this statement ? Give your reasons.

c) Explain the following two noise removal technique :

i) Neighbourhood averaging

ii) Median filtering.

Calculate the value of the shaded pixel of the following image segment when the above techniques are applied with 3 ∞ 3 neighbourhood.

3	4	4	5	5
1	3	5	7	6
2	2	3	6	6
3	2	5	6	6
3	3	4	5	5

6 + 1 + 8

10. a) A waveform $g(x)$ defined at equally spaced set of points $x = 0, 1, 2, 3, 4$ is given by 1, 2, 4, 5, 5.

i) Compute the discrete Fourier transform of $g(x)$

ii) Compute the amplitude spectrum of $g(x)$.

b) State and prove convolution theorem.

c) What is physical significance of convolution and correlation in image processing ?

d) Demonstrate convolution of the function $f(x)$ and $g(x)$ shown respectively :

Dia.

5 + 4 + 2 + 4

11. a) What are the types of redundancies normally available in an image ?

b) What is compression ratio ?

c) What is the role of quantization in image compression ?

d) Compute the Huffman codes for the source symbols the probabilities of which are given below. Compute the entropy :

Symbol	***Probability***
S1	0·19
S2	0·21
S3	0·25
S4	0·08
S5	0·16
S6	0·06
S7	0·02
S8	0·03

2 + 2 + 4 + 7