Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (ECE)/SEM-8/EC-803D/2012

2012
DIGITAL 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.

Graph Sheet(s) will be supplied by the Institute on demand.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of 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) Sampling of an image required for

a) quantization b) sharpening

c) smoothing d) digitization.

iv) The effect, caused by the use of an insufficient number of gray levels in smooth areas of a digital image is called

a) false counting b) gray levels slicing

c) bit plane d) thinning.

v) Intensity range of 8-bit pixel image is

a) 0 to 7 b) 0 to 15

c) 0 to 31 d) 0 to 255.

vi) Consider an image of size M × N with 64 gray levels. The total number of bits required to store this digitized image is

a) M × N × 64

b) M × N × 63

c) M × N × 6

d) M × N × 8.

vii) In 8 distance measurement system, distance between centre pixel and a corner pixel is

a) 2 units b) $\sqrt{2}$ units

c) 1 unit d) 1·5 units.

viii) Wiener Filter is used for

a) restoration b) smoothening

c) sharpening d) none of these.

ix) Representation & description almost always follow the output of a

a) segmentation stage b) filtering stage

c) compression stage d) all of these.

x) How many numbers of colours are present in RGB ?

a) 3 b) 6

c) 216 d) 256.

xi) Knowledge of which one of the following is not required for morphological image processing ?

a) Erosion

b) Morphological reconstruction

c) Neural networking

d) Duality & dilation.

xii) Periodic noise happened due to

a) infinite frequency

b) electrical & electromechanical interface during acquisition.

c) ringing effect

d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define 4-adjacency, 8-adjacency and *m*-adjacency. Consider the two-image subset S1 and S2 shown below :

	S1				S2				
0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	0	0	1
1	0	0	1	0	1	1	0	0	0
0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1

For $v = \{1\}$, determine whether S1 and S2 are

(i) 4-connected

(ii) 8-connected

(iii) *m*-connected. 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 resolution of an image ? Compute the size of a 640×480 image at 240 pixels per inch. 2 + 3

5. What is understood by spatial domain representation ? Compute the Inverse Fourier Transform using Forward Transform Algorithm. 5

6. What is salt and pepper noise ? What is Quad-tree ? 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What do you mean by image negative ? Explain.

   b) Explain Intensity slicing with example.

   c) Why do we need Log Transformation in dynamic range compression ? 5 + 5 + 5

8. a) What do you mean by redundancy and compression ratio ?

   b) What is the difference between lossy and lossless compression ?

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

   d) For the image shown below, compute the compression ratio by using Huffman coding. Assume that the pixel value is represented by 8 bits.

13	13	13	12
12	33	33	33
33	22	22	22
22	11	11	12

3 + 2 + 3 + 7

9. a) Describe the region growing technique for image segmentation and mention the problem associate with it.

   b) Discuss the Hough transform method for edge linking.

   c) Explain the restoration model for continuous function in detail. 5 + 5 + 5

10. a) What is image averaging ?

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

    c) Equalize the following histogram. Show the histogram before and after equalization. 3 + 4 + 8

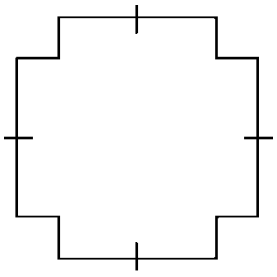
Gray Level	0	1	2	3	4	5	6	7
Number of pixels	10	20	12	8	0	0	0	0

11. a) Show that the first difference of a chain code normalizes it to rotation.

    b) Compute the first difference of the code 0110233210332322111.

    c) What is the order of the shape number for the figure shown ?

    d) Obtain the shape number. 4 + 3 + 4 + 4



12. Write short notes on any *three* of the following : 3 × 5 = 15

a) Discrete cosine transforms

b) Edge detection operators

c) Forward 2D wavelet transforms

d) Filtering in frequency domain

e) Contrast stretching.