Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(IT)/SEP.SUPPLE/SEM-7/IT-703B/2012

2012

IMAGE PROCESSING AND GIS

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 × 1 = 10

   i) An image of size 1024 × 1024 pixels in which the intensity of each pixel is an 8 bit quantity requires the storage space (if not compressed)

      a) 1 kB

      b) 1 MB

      c) 2 kB

      d) 2 MB.

ii) In image processing technique the input and output are

a) low quality image and improved quality image

b) description and image

c) image and description

d) low quality image and description.

iii) 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.

iv) Sampling of an image is required for

a) Quantization b) Sharpening

c) Smoothing d) Digitization.

v) The negative of an image with gray levels in the range [0, $L - 1$] is obtained by using the negative transformation, which is given by the expression

a) $s = L - 1 - r$ b) $s = L - 1 + r$

c) $s = L - 1$ d) $s = L - r$.

vi) Intensity range of 8-bit pixel image is

a) 0 to 7 b) 0 to 15

c) 0 to 31 d) 0 to 255.

vii) Time complexity of mean filter is

a) greater than median filter

b) smaller than median filter

c) equal to median filter

d) cannot be compared to median filter.

viii) Linear stretching

a) uniformly distributes the pixels of an image

b) uniformly distributes the intensity of an image

c) sharpens the image

d) add noise to the image.

ix) Region growing is a process used in

a) segmentation b) edge detection

c) thinning d) noise removal.

x) A pixel p at coordinates (x, y) has four horizontal and vertical neighbours whose coordinates are given by

a) $(x-1, y-1), (x-1, y), (x, y-1), (x, y+1)$

b) $(x+1, y), (x-1, y), (x, y+1), (x, y-1)$

c) $(x+1, y-1), (x-1, y), (x-1, y+1), (x, y+1)$

d) $(x+1, y), (x+1, y-1), (x, y+1), (x-1, y+1)$.

GROUP – B
(Short Answer Type Questions)

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

2. Discuss a method for estimating thresholds that produce the minimum average segmentation error. 5

3. How raster based analysis is used in GIS ? 5

4. Derive the expression for mean filter. Discuss the effect of window size on the performance of a mean filter. 2 + 3

5. Describe the region growing technique for image segmentation and mention the problems associated to it. 5

6. Discuss the Hough transform method for edge linking. 5

GROUP – C

(Long Answer Type Questions)

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

7. a) What is pixel connectivity and what are neighbour pixels ? Show a four-neighbour and an eight-neighbour pixel grids. 4

   b) Write down the discrete Fourier Transformation relations in 2-D. For 4 × 4 image show the Fourier Transformation matrix W_4 (calculate the elements of the matrix). 2 + 6

   c) How does the discrete cosine transform differ from the DFT ? Is it the real part of DFT ? 2 + 1

8. a) What do you mean by a histogram and its equalization ? 4

b) Consider the following image : 6

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

Where is gray level range zero to fifteen ? Equalize the above image histogram.

Show the histogram before and after equalization.

c) How is high pass filtering done in frequency domain ? What is its effect on the image ? 5

9. a) What do you mean by image capturing and image digitization ? How are gray level images represented ? 5

b) Draw the block diagram of an image processing system and explain the roles of its different parts. 5

c) Define the basic geometrical transformation matrices for images in homogeneous notation. 5

10. a) What is image enhancement ? 3

b) Why is low pass spatial filtering used for image ? 4

c) What is the net effect of high pass filtering for a gray scaled image ? 4

d) What are the masks used in case of image filtering ? 4

11. a) Classify different image segmentation techniques. 5

b) Describe how line segments can be detected using Hough transform. 5

c) Consider the line $y = 3x + 4$. Draw four corresponding lines in the transformed space where the lines intersect at the point (3, 4). 5