Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(IT)/SEM-7/IT-703B/2009-10

2009

IMAGE PROCESSING & 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 of the following : 10 × 1 = 10

   i) A common technique for enhancing the appearance of images is

      a) splitting and merging

      b) region growing

      c) watershed segmentation

      d) histogram equalization.

   ii) Image degradation causes

      a) linearity of the optical sensor

      b) relative motion between an object and camera

      c) proper focus

      d) none of these.

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

iv) The convolution of two functions $f(x, y)$ and $g(x, y)$ denoted by $f(x, y) * g(x, y)$, is defined as

a) $f(x, y) * g(x, y) = \int_0^{\infty} \int_0^{\infty} f(\alpha, \beta)\, g(x-\alpha, y-\beta)\, d\alpha\, d\beta$

b) $f(x, y) * g(x, y) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(\alpha, \beta)\, g(x-\alpha, y-\beta)\, d\alpha\, d\beta$

c) $f(x, y) * g(x, y) = \int_{-\infty}^{\infty} \int_0^{\infty} g(\alpha, \beta)\, f(x-\alpha, y-\beta)\, d\alpha\, d\beta$

d) none of these.

v) Region growing is a process used in

a) segmentation b) edge detection

c) thinning d) noise removal.

vi) 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.

vii) A spatial averaging filter in which all co-efficients are equal is called a

a) weighted average filter

b) box filter

c) median filter

d) none of these.

viii) The D_8 distance (chessboard distance) between $p(x, y)$ and $q(s, t)$ is defined as

a) $D_8(p, q) = |x - s| + |y - t|$

b) $D_8(p, q) = \text{Max}(|x - s|, |y - t|)$

c) $D_8(p, q) = [(x - s)^2, (y - t)^2]^{\frac{1}{2}}$

d) none of these.

ix) Linear stretching

a) uniformly distributes the pixels of an image

b) uniformly distributes the intensity of an image

c) sharpens the image

d) adds noise to the image.

x) In 8-distance measurement system distance between centre pixel and a corner pixel is

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

c) 1 unit d) 1·5 unit.

GROUP – B
(Short Answer Type Questions)

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

2. a) In transform-based image compression, DCT is widely used than other transforms. Give two reasons for the popularity of DCT in transform-based image compression. 3

b) What is blocking artefact ? 2

3. Compare the Canny edge detector with Laplacian of Gaussian edge detector.

4. Explain the classification of vector based GIS data processing methods.

5. Describe the low-pass filtering technique. Why is it required ?

6. a) What do you mean by image capturing and image digitization ? 3

   b) How are gray level images represented ? 2

GROUP – C
(Long Answer Type Questions)

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

7. a) Explain pixel conductivity and neighbours of a pixel. 4

   b) Show 4-adjacency, 8-adjacency and *m*-adjacency pixel grids. 3

   c) Write down the discrete Fourier transformation relations in 2-D for $4 \infty 4$ image. Show the Fourier transformation matrix W_4 . Calculate the elements of the matrix. 8

8. a) Discuss advantages of separable filters. 4

   b) Show that 2-D Gaussian is separable, while the Laplacian of a Gaussian operator (LOG) is not separable. 4

   c) The region-growing algorithm starts with a seed pixel and its selection depends on application. You are given two applications; Suggest a way to choose the seed pixel for each of the following : 2 + 2

      i) Target detection in night vision

      ii) Mamogram.

   d) What are the advantages / disadvantages if more than one seed are used in a region-growing technique ? 3

9. a) What is image degradation ? Specify different causes for it. 1 + 2

b) Discuss three types of image-blur. 3 ∞ 2

c) Discuss two widely used and popular metrices used in the image restoration field. 3 + 3

10. Write short notes on any *three* of the following : 3 × 5

a) Discrete cosine transform

b) Hough transform

c) Constrained least square restoration

d) Histogram equalization

e) Sobel method of edge detection.

11. a) Give the definition of GIS. 2

b) Discuss the geographic system of earth. 3

c) How can the map projection be expressed mathematically by the generalized functional relationship between geographic coordinates ? 2

d) Discuss the major application areas of GIS. 3

e) Explain GPS. Provide a few applications of GPS. 2 + 3

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

b) Consider the following image :

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. 6

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