



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 : $10 \times 1 = 10$
 - 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.



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- 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. $3 \times 5 = 15$

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.



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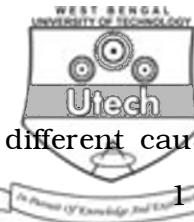
5. Describe the low-pass filtering technique. Why is it required ?
6. a) What do you mean by image capturing and image digitization ? 3
- b) How are gray level images represented ? 2

GROUP - C

(Long Answer Type Questions)

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

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 4×4 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



1 + 2

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

b) Discuss three types of image-blur. 3 \propto 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 \times 5

a) Discrete cosine transform

b) Hough transform

c) Constrained least square restoration

d) Histogram equalization

e) Sobel method of edge detection.

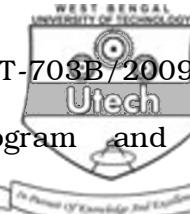
11. a) Give the definition of GIS. 2

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



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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
