



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

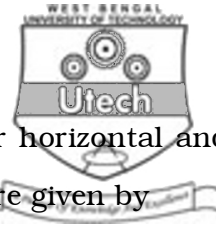
The figures in the margin indicate full marks.

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

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

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

d) none of these.



- v) Region growing is a process used in
- segmentation
 - edge detection
 - thinning
 - noise removal.
- vi) Time complexity of mean filter is
- greater than median filter
 - smaller than median filter
 - equal to median filter
 - cannot be compared to median filter.
- vii) A spatial averaging filter in which all co-efficients are equal is called a
- weighted average filter
 - box filter
 - median filter
 - none of these.
- viii) The D_8 distance (chessboard distance) between $p(x, y)$ and $q(s, t)$ is defined as
- $D_8(p, q) = |x - s| + |y - t|$
 - $D_8(p, q) = \text{Max}(|x - s|, |y - t|)$
 - $D_8(p, q) = [(x - s)^2 + (y - t)^2]^{\frac{1}{2}}$
 - 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.



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

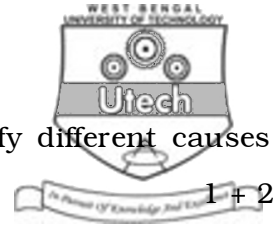
GROUP – C

(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

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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 metrics 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
