



Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech (IT)/SEM-3/PGIT-302A/2012-13

2012

ADVANCED IMAGING TECHNOLOGY

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

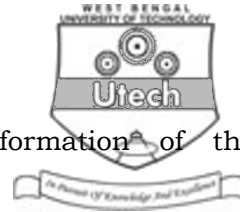
(Short Answer Type Questions)

1. Answer any *five* of the following. $5 \times 5 = 25$

- a) What would be the effect on the histogram for the following 4 bit gray scale image segment if we set to zero in first two bit planes ?

0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

- b) Define unsharp masking and high boost filtering techniques of an image in spatial domain.



- c) Determine Discrete Fourier transformation of the following image segment :

0	1	2	1
1	2	3	2
2	3	4	3
1	2	3	2

- d) What is meant by image enhancement by mask processing ? Discuss any one method in it.
- e) Define digital image model mathematically. What is the difference between sampling and quantization ?
- f) Define Fourier spectrum, phase angle and power spectrum of a digital image.
- g) Show that subtracting the Laplacian from an image is proportional to unsharp masking.

GROUP – B

(Long Answer Type Questions)

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

2. a) Define different types of adjacency between pixels.

Consider the following 6×7 binary image segment, some of the pixels being highlighted :

0	1	0	0	1(e)	0	1(a)
0	0	0	1	1	0	1
1	1	1	0	1	1	1
0	1	1	1(d)	0	0	0
1	1	1(c)	0	1	0	0
(b)1	1	1	0	0	0	1

Let $\mathbf{V} = \{1\}$ be the set of gray-level values used to define adjacency between pixels.



- b) Determine whether the pixels **c** and **d** are 4-adjacent, 8-adjacent and *m*-adjacent with explanation.
- c) Find the 8-adjacent and *m*-adjacent paths if exists between the pixels **a** and **b**.
- d) Find the city block (D_4) and chessboard (D_8) distances between the pixels **a** and **b**.
- e) Define connectivity between pixels. Determine whether the pixels **b** and **e** are connected or not. Explain why.

$$3 + 3 + 4 + 2 + 3$$

3. a) What is meant by image enhancement by point processing ? Discuss any two methods in it.
- b) Perform histogram stretching so that the new image has a dynamic range of $[0,7]$:

Gray level	0	1	2	3	4	5	6	7
Number of pixels	0	20	30	40	30	10	20	0

- c) Find the histogram equalized image of the following 3-bit image segment :

0	1	2	3
0	4	3	4
1	3	4	5
1	3	5	7
4	6	1	6

$$4 + 5 + 6$$



4. a) What is low-pass filter in frequency domain ? Discuss any one low-pass filtering method in frequency domain.
 b) Explain why the discrete histogram equalization techniques do not, in general, yield a flat histogram.
 c) Suppose that a flat area with centre at (x_0, y_0) is illuminated by a light source with intensity distribution

$$i(x, y) = Ke^{-(x-x_0)^2 + (y-y_0)^2}$$

Assume for simplicity that the reflectance of the area is constant and equal to 1.0, and let $K = 255$. If the resulting image is digitized with m bits of intensity resolution, and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what value of m will cause visible false contouring ? 4 + 5 + 6

5. a) Write an algorithm for converting a gray scale image to binary.
 b) What is sobel operator ? Explain with an example.
 c) Derive the expression for image averaging. Discuss the effect of the following image by taking 3×3 window sizes :

3	1	2	3
4	4	3	4
10	3	20	5
1	3	5	7
4	6	1	6

3 + 5 + 7

6. a) Explain Euclidian distance, city block distance and chessboard distance with examples.
 b) Derive the expression for Laplacian operator in 2-dimension. Also show that Laplacian is linear operator.
 c) What do you mean by digital image processing ? Discuss the different application areas of digital image processing. 5 + 6 + 4