Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (IT)/SEM-7/IT-703B/2011-12

2011

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 : $10 \times 1 = 10$

   i) The image function $f(x, y)$ is characterized by two components : $f(x, y) = i(x, y).\, r(x, y)$ where

   a) $0 < i(x, y) < 1$ & $0 < r(x, y) < \infty$

   b) $0 < i(x, y) < 1$ & $0 < r(x, y) < 1$

   c) $0 < i(x, y) < \infty$ & $0 < r(x, y) < \infty$

   d) $0 < i(x, y) < \infty$ & $0 < r(x, y) < 1$.

   ii) Consider an image of size $M \times N$ with 256 grey levels. The total number of bits required to store this digitized image is

   a) $M \times N \times 256$ b) $M \times N \times 255$

   c) $M \times N \times 8$ d) None of these.

iii) Quantization is

a) digitizing the co-ordinate value (x, y)

b) digitizing the intensity value

c) digitizing the amplitude value

d) digitizing the pixel value.

iv) Smoothing in frequency domain is achieved by

a) Homomorfic filter b) Low-pass filter

c) Wiener Filter d) High-pass filter.

v) A spatial averaging filter in which all co-efficienct are equal is called a

a) Weighted average filter

b) Box filter

c) Watershed segmentation

d) Histogram equalization.

vi) Contrast stretching is an

a) image segmentation technique

b) image enhancement technique

c) image restoration technique

d) none of these.

vii) In a gray scale image where pixel values are ranging from 0-255, how much space is necessary to store one pixel

a) 16 bit b) 32 bit

c) 24 bit d) 8 bit.

viii) Line detection is a

a) Feature extraction process

b) Image registration process

c) Global mapping model

d) None of these.

ix) A 2000-foot road is represented on a map with a 1-inch line. What is the map scale ?

a) 1 : 24,000 b) 1 : 2,400

c) 1 : 2, 000 d) None of these.

x) Adaptive threshold is a

a) point operator

b) a filtering technique

c) region growing technique

d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. a) What is the difference between global and local thresholding ?

b) What do you mean by dynamic thresholding ? 3 + 2

3. What is image smoothing and image sharpening ?

4. The following figure below shows

   i) a 3-bit image of size 5-by-5 image in the square, with x and y coordinates specified

   ii) a Laplacian filter and

   iii) a low-pass filter.

y \ x	0	1	2	3	4
1	3	7	6	2	0
2	2	4	6	1	1
3	4	7	2	5	4
4	3	0	6	2	1
5	5	7	5	1	2

Laplacian Filter

0	1	0
1	– 4	1
0	1	0

Low pass Filter

0·01	0·1	0·01
0·10	0·56	0·10
0·01	0·1	0·01

Compute the following :

   a) The output of a 3 × 3 median Filter at (2, 2)

   b) The output of the 3 × 3 Laplacian Filter shown above at (2, 2)

   c) The output of the 3 × 3 low-pass Filter shown above at (2, 2). 1 + 2 + 2

5. a) What is vectorization and why is it required in GIS ?

   b) What is weber ratio ? 3 + 2

6. Explain Spatial and Gray Level resolution.

GROUP – C

(Long Answer Type Questions)

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

7. a) Consider the two image subsets, $S1$ and $S2$, show in the following figure. For $V = \{ 1 \}$, determine whether these two subsets are

i) 4-adjacent,

ii) 8-adjacent or

iii) m-adjacent.

			S_1				S_2		
0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	0	0	1
1	0	0	1	0	1	1	0	0	0
0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1

b) What are gray image and binary image ?

c) Consider the image segment shown :

i) Let $V = \{ 0, 1 \}$ and compute the lengths of the shortest 4-, 8- and m-path between p and q. If a particular path does not exist between these two points, explain why.

ii) Repeat $v = \{ 1, 2 \}$.

	3	1	2	1	(q)
	2	2	0	2	
	1	2	1	1	
(p)	1	0	1	2	

6 + 2 + 7

8. a) Compute Full Convolution and Correlation result for the following image segment f using given filter w.

Origin $f (x, y)$

0	0	0	0	0
0	0	0	0	0
0	0	1	0	0
0	0	0	0	0
0	0	0	0	0

$w (x, y)$

1	2	3
4	5	6
7	8	9

b) Discuss the contrast stretching method for image enhancement.

c) Suppose that a 3-bit image (L = 8) of size 64 × 64 pixels (MN = 4096) has the intensity distribution shown below, where the intensity levels are integer in the range [0, 7]. Draw its original histogram, transformation function and equalized histogram.

r_k	n_k
$r_0 = 0$	790
$r_1 = 1$	1023
$r_2 = 2$	850
$r_3 = 3$	656
$r_4 = 4$	329
$r_5 = 5$	245
$r_6 = 6$	122
$r_7 = 7$	81

5 + 5 + 5

9. a) What is meant by GIS ?

b) What are the functions of GIS ?

c) What are the features of GIS ?

d) Describe the perspective projection. 2 + 3 + 3 + 7

10. a) Describe the following operations :

    i) Median filtering

    ii) Lowpass spatial filtering.

    b) Describe the process of Histogram equalization. What purpose does it serve ? (5 + 5) + 5

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

    a) Homomorphic filtering

    b) Hough transform

    c) Point processing

    d) Discrete cosine transform

    e) Pixel connectivity

    f) Constrained least square filtering.