Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(IT)/SEM-7/IT-703B/2012-13

2012

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 :

   $$f(x, y) = i(x, y) \cdot r(x, y)$$

   where

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

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

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

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

ii) Consider an image of size M × N with 256 gray levels. The total number of bits required to store this digitized image is

a) M × N × 256 b) M × N × 255

c) M × N × 8 d) None of these.

iii) The effect, caused by the use of an insufficient number of gray levels in smooth areas of a digital image is called

a) False contouring b) Gray level slicing

c) Bit plane d) None of these.

iv) The D_8 distance (chessboard distance) between p and q with co-ordinates (x, y), (s, t) is defined as

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

b) $D_8(p, q) = \max (| x - s |, | y - t |)$

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

d) none of these.

v) A transformation function with the property $T(r) = 0$ for r in the range $[x, y]$ and $T(r) = 255$ for r in the range $[p, q]$ produces an image of the 7th bit plane is an 8-bit image where x, y, p, q are

a) $x = 128, y = 255, \quad p = 0, q = 128$

b) $x = 0, \quad y = 127, p = 128, q = 255$

c) $x = 0, y = 63, p = 64, q = 127$

d) none of these.

vi) 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.

vii) ..... is a common technique for enhancing the appearance of images

a) Splitting and merging

b) Region growing

c) Watershed segmentation

d) Histogram equalization.

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

a) $f(x, y) * g(x, y) = \int_{0}^{\infty} f(\alpha, \beta)\, g(x - \alpha, y - \beta)\, d\alpha\, d\beta$

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

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

d) None of these.

ix) Give $F(u, v)$, the inverse Fourier transform is $\mathcal{F}^{-1}\{ F(u, v) \} = f(x, y)$ where $f(x, y)$ is defined as

a) $\int_{-\infty}^{\infty} \int F(u, v) \exp\left[J2\pi (ux + vy)\right] du\, dv$

b) $\int_{-\infty}^{\infty} \int F(u, v) \exp\left[J\pi (ux + vy)\right] du\, dv$

c) $\int_{-\infty}^{\infty} \int F(u, v) \exp\left[J4\pi (ux + vy)\right] du\, dv$

d) None of these.

x) Image Degradation causes

a) linearity of the optical sensor

b) relative motion between an object and camera

c) proper focus

d) None of these.

GROUP – B

(Short Answer Type Questions)

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

2. a) What is Weber ratio ?

   b) Define 4-adjacency, 8-adjacency and *m*-adjacency.

   2 + 3

3. a) What are gray image and binary image ?

   b) What is salt and paper noise ?

   c) What is the basic equation for getting a negative image ?

   2 + 2 + 1

4. a) Write down the characteristics of perspective projection.

   b) What is understood by vanishing point ? 4 + 1

5. What are image smoothing and image sharpening ? 5

GROUP – C

(Long Answer Type Questions)

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

6. a) What do you mean by image enhancement ? Explain.

   b) What are Mean and Median filters ? Compare their performance.

   c) Describe high pass filter and low pass filter. Explain when they are used. 4 + 6 + 5

7. a) What is meant by GIS ?

   b) What are the functions of GIS ?

   c) What are the features of GIS ?

   d) Discuss the 'contrast stretching' method for image enhancement. 3 + 3 + 4 + 5

8 a) What is digital image ? Discuss the fundamental step in digital image processing.

   b) Briefly discuss the image acquisition technique using a sensor array.

   c) What is spatial and gray-level resolution of a digital image ? 6 + 6 + 3

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

   a) Discrete cosine transform

   b) High and low pass filters

   c) Properties of two-dimensional Fourier transform

   d) Histogram Equalization.