



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(CSE)/SEM-7/CS-704G/2009-10**

**2009**

**IMAGE PROCESSING**

Time Allotted : 3 Hours

Full Marks : 70

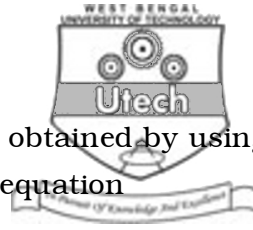
*The figures in the margin indicate full marks.*

*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) What will be the number of bits required to store a  $256 \times 256$  image with 32 gray levels ?
    - a) 256 bits
    - b) 327680 bits
    - c) 255 bits
    - d)  $256 \times 256 \times 32$  bits.
  - ii) 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.



iii) The log transformation of an image is obtained by using the transformation, which is given by equation

- a)  $S = c \log (1 + r)$  where  $c$ -constant and  $r < 0$
- b)  $S = c \log (1 + r)$  where  $c$ -constant and  $r = 0$
- c)  $S = c \log (1 + r)$  where  $c$ -constant and  $r > 0$
- d)  $S = c \log (r)$  where  $c$ -constant and  $r > 0$ .

iv) Homomorphic filtering deals with ..... components of an image.

- a) gray levels
- b) illumination
- c) illumination and reflectance
- d) reflectance.

v) Smoothing in frequency domain is achieved by

- a) homomorphic filter      b) low-pass filters
- c) Wiener filter              d) high-pass filter.

vi) A function  $d(p, q)$  of the coordinates of two pixels  $p$  and  $q$  is called a distance function if which of the following condition is true ?

- a)  $d(p, q) = d(q, p)$
- b)  $d(p, q) + d(q, p) = 0$
- c)  $d(p, q) + d(q, p) = 1$
- d)  $d(p, q) - d(q, p) = 1$ .

- content can be defined as

a) blocks                      b) regions  
c) pixels                     d) vertices.



**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

3 × 5 = 15

2. a) What are the steps involved in digital image processing ?  
b) Explain briefly various functional block of digital image processing. 2 + 3
3. a) What are the differences between enhancement and restoration ?  
b) What do you mean by point processing ?  
c) Define high boost filter. 2 + 2 + 1
4. A binary image contains straight lines oriented horizontally, vertically at 45° and – 45°. Give a set of 3 × 3 masks that can be used to detect 1-pixel long breaks in these lines. Assume that the gray level of the lines is 1 and that the gray level of the background is 0. 5
5. Explain how the F-T can be used in implement high-pass filter and low-pass filter ? 5
6. a) Develop a procedure for computing the median of an  $n \times n$  neighbourhood.  $2\frac{1}{2}$   
b) Propose a technique for updating the median as the centre of the neighbourhood is moved from pixel to pixel.  $2\frac{1}{2}$

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.

3 × 15 = 45

7. a) How digital images can be represented ?  
b) Discuss about image subtraction and image overaging.



- c) Distinguish between digital image and binary image.
- d) In the Hough Transform, a point  $(x_o, y_o)$  in the  $xy$ -plane is mapped into a curve in the  $(\rho, \theta)$  parameter space. Write down the equation of the curve.
- e) 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.

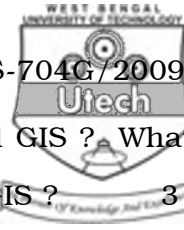
Compute the following :

- i) The output of a  $3 \times 3$  median filter at  $(2, 2)$ .
- ii) The output of the  $3 \times 3$  Laplacian filter shown above at  $(2, 2)$ .
- iii) The output of the  $3 \times 3$  low-pass filter shown above at  $(2, 2)$ .
- iv) The histogram of the whole image.

$$2 + 3 + 3 + 2 + (1 + 1 + 1 + 2)$$



8. a) Describe the technique of histogram specification.
- b) An image has the gray level probability density function  $p_r(r)$  shown in the following diagram. It is desired to transform the gray levels of this image so that they will have the specified probability density function  $p_z(z)$  shown. Assume continuous quantities and find the transformation ( in terms of  $r$  and  $z$  ) that will accomplish this.
- c) Suppose a digital image is subjected to histogram equalization. What effect will a second pass equalization have over the equalized image ? 5 + 6 + 4
9. a) Suppose an image contains two types of regions whose gray level follows Gaussian distribution with mean  $m_1$  and  $m_2$  and standard deviation  $s_1$  and  $s_2$  respectively. Suppose the *a priori* probabilities of the pixels of two types of regions are  $P_1$  and  $P_2$ . Find the optimum value of threshold. 7
- b) Explain how the edge detection is obtained by Robert's operator, Prewitt and Sobel operators and compare all. 2 + 2 + 2 + 2



10. a) What is the difference between GPS and GIS ? What is vectorization and why is it requiring in GIS ? 3 + 4

b) How does a GIS work ? What is the spatial operation of GIS ? What are the applications of GIS ? 3 + 3 + 2

11. a) Prove the validity of the convolution theorem using single variable continuous function. 7

b) What is Haar Transform ? Compute the Haar Transform of the  $2 \times 2$  image. 3 + 5

$$F = \begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix}$$

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

- a) Imaging geometry
- b) Hadamard transform
- c) Edge detection and edge linking
- d) Projection
- e) Hough transform
- f) Contrast enhancement
- g) Power spectrum.

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