Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(BME)/SEM-8/BME-801/2011

2011

MEDICAL 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 for the following :

$10 \times 1 = 10$

i) If I stands for unit matrix, then the matrix U is said to be 'unitary' if

a) $U^{T*} U = U^{-1}$

b) $UU^{T*} = U^{-1}$

c) $UU^{T*} = I$

d) $U^{T*} U = I$.

ii) In Bit-plane slicing method, the higher order bits give

a) Gross structure of the image

b) Fine structure of the image

c) Brightness of the image

d) Contrast of the image.

iii) An impulse noise is considered as

a) Multiplicative noise b) Erlang noise

c) Normal noise d) Additive noise.

iv) High contrast image has ..... distribution of histogram.

a) lower end b) gigher end

c) narrow range d) wider range.

v) FBP stands for

a) False blurred point

b) Finite blurred position

c) Fan beam projection

d) Fourier beam projection.

vi) Image smoothing in frequency domain filtering is achieved maximum by

a) Ideal low-pass filter

b) Gaussian filter

c) Buterworth filter

d) Chebyshev filter.

vii) Generic complexity of Global operator is

a) Constant b) Variable

c) P^2 d) N^2.

viii) Huffman code efficiency is ..... %.

a) 80 b) 85

c) 90 d) 97.

ix) Which of the following algebraic approaches is more flexible in image restoration process ?

a) Unconstrained b) Constrained

c) Both (a) & (b) d) None of these.

x) Zero-crossing is a phenomenon occurs in

a) point detection

b) line detection

c) edge detection

d) smooth surface detection.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What are Adjacency, Connectivity and Path ? $2 + 1\frac{1}{2} + 1\frac{1}{2}$

3. a) You are given an image which is represented by a matrix G : Prove that GG^T is symmetric.

   b) How can you write the diserete Fourier transform in matrix form ? 2 + 3

4. Draw HSI Model with a neat sketch and define each term. 5

5. What is Image Restoration ? 5

6. What do you mean by zero-crossing ? How can you obtain a line from an edge ? 1 + 4

7. a) Write two basic prerequisites to implement algebraic reconstruction techniques applied in the process of image reconstruction from projection.

   b) What is the meaning of the point spread function ? 2 + 3

GROUP – C

(Long Answer Type Questions)

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

8. a) Describe the technique of Histogram matching.

b) How can you adjust the brightness of an image on a CRT ?

c) How does an ideal low-pass filter work for image smoothing in frequency domain ? What are the methodologies of using Butterworth filter for the same ?

5 + 4 + (3 + 3)

9. a) Confirm the realationship between the average of the image g and its DFT, where g is given by

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

b) Why do we need the statistical description of images ?

c) What is an intensity image ? What do you mean by City block distance and Chessboard distance ?

5 + 4 + (2 + 4)

10. a) How can you enhance the dark region of an image, keeping the bright region unchanged of a gray scale image ?

    b) How can you keep the information of edges of an image while filtering with a mask ? Give a probable algorithm to support your answer.

    c) What do you mean by Hamming code ? 5 + 5 + 5

11. a) What is the basic difference between image enhancement and image restroration ? How do we define a 2D filter ?

    b) How can we obtain information on the transfer function H (u, v) of the image degradation process ? What happens to the point (u, v) when H (u, v) = 0 ?

    c) Draw the model of the image degradation / restoration process. Give an example of circulant matrix.

    (2 + 2) + (4 + 3) + (3 + 1)

12. a) What do you mean by fidelity criteria ? Obtain an expression for mean square SNR in case of objective fidelity criteria.

    b) What is Huffman coding ? Explain in detail the method of Huffman coding considering six character symbol.

    (3 + 4) + (2 + 6)

13. a) What exactly is the purpose of image segmentation and edge detection ? Are there any segmentation methods that taken into consideration for the spatial proximity of pixels ?

b) Briefly explain the ways of measuring distance between two pixels.

c) Name two well known image degradation phenomena. Express an image function $f(x, y)$ as an M × N matrix form. (3 + 3) + 6 + (1 + 2)