



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 × 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.

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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 discrete 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. $3 \times 15 = 45$

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 relationship between the average of the image g and its DFT, where g is given by

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

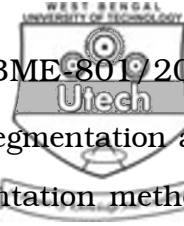
- b) Why do we need the statistical description of images ?
- c) What is an intensity image ? What do you mean by City block distance and Chessboard distance ?

$5 + 4 + (2 + 4)$



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 restoration ? 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 $M \times N$ matrix form. (3 + 3) + 6 + (1 + 2)

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