(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2883 Roll No. | | | | | | | | | | |

**B.Tech.**

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2012-13

## DIGITAL IMAGE PROCESSING

*Time : 3 Hours* *Total Marks : 100*

**Note :—** *(1) Attempt **all** the questions.*

*(2) All questions carry equal marks.*

1. Attempt any **FOUR** parts : **(5×4=20)**

(a) Explain the various steps of Digital Image Processing with diagram.

(b) Explain the sampling and quantization of images with the help of suitable diagram.

(c) State and prove Haar transform and compute the two dimensional (2D) Haar transform of the signal

$$f(m, n) = \begin{pmatrix} 4 & -1 \\ 2 & 3 \end{pmatrix}.$$

(d) Prove that the inverse of two dimensional (2D) Fourier transform of the two dimensional Fourier transform of f(m, n) is f(–m, –n).

(e) Define connectivity. Differentiate 8-connectivity and m-connectivity.

(f) Apply DFT of the following matrices :

$$\begin{pmatrix} 2 & 2 \\ 0 & 1 \end{pmatrix}$$

2. Attempt any **TWO** parts :— **(10×2=20)**

(a) Discuss Histogram modeling of image enhancement. Perform histogram equalization on the following images :

| Grey levels ($r_k$) | No. of pixels ($p_k$) |
|---|---|
| 0 | 8 |
| 1 | 10 |
| 2 | 10 |
| 3 | 2 |
| 4 | 12 |
| 5 | 16 |
| 6 | 4 |
| 7 | 2 |

(b) Show how the KL transform is useful for reducing the dimensions of images. Explain KL transform with properties and apply KL transform for the following matrix :

$$X = \begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix}.$$

(c) Explain Hadamard transform for digital images and prove Hadamard transform and inverse Hadamard transform works for the following images :

$$F = \begin{pmatrix} 2 & 2 \\ 2 & 1 \end{pmatrix}.$$

3. Attempt any **TWO** parts :— **(10×2=20)**

(a) Explain Image observation model.

(b) Differentiate the following :

(i) Image enhancement & Image restoration

(ii) Inverse filter & Wiener filter.

(c) State bit plane slicing for image restoration and show the bit plane slicing of the following image :

| | | |
|---|---|---|
| 7 | 6 | 5 |
| 4 | 3 | 2 |
| 1 | 1 | 0 |

4. Attempt any **TWO** parts : **(10×2=20)**

(a) State and prove Huffmann algorithm for image compression and explain the difference between arithmetic coding and huffmann coding. Calculate the huffmann coding for the set of symbols shown in table :—

| Symbol | : | A | B | C | D |
|---|---|---|---|---|---|
| Probability | : | 0.4 | 0.3 | 0.2 | 0.1 |

(b) Discuss adaptive predictive coding for image. Demonstrate the predictive coding for the pixels {23, 34, 39, 47, 55, 63}.

(c) Consider an image stripe of size 100 × 100. The image consists of four vertical stripes. The Grey levels of the stripes from left to right are 64, 32, 16 and 8. The

corresponding width of the stripes are 40, 30, 20 and 10 pixels for this striped images. Compute the entropy in bits per pixel.

5. Attempt any **TWO** parts :— **(10×2=20)**

(a) Explain in detail the stages of Edge Detection algorithm.

(b) Explain the following Edge Extraction operators :

(i) Sobel operator

(ii) Roberts operator.

(c) Write a short note on Image Segmentation Techniques.