Duration: 3hrs **[Max Marks: 80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required, and state it clearly.

1 Attempt **any FOUR.** **[20]**

a Perform bit-plane slicing on the following image.

$$I = \begin{bmatrix} 12 & 14 & 9 \\ 7 & 11 & 10 \\ 5 & 6 & 8 \end{bmatrix}$$

Reconstruct the image after discarding the LSB plane.

b State the basic steps in frequency domain filtering.

c Define morphological erosion and dilation of a binary image.

d State the principle of basic global thresholding.

e Compute the co-occurrence matrix $C_{1,0}$ of the following image. (One pixel to the right)

$$I = \begin{bmatrix} 3 & 1 & 1 & 0 & 1 \\ 0 & 1 & 2 & 2 & 1 \\ 1 & 0 & 1 & 2 & 1 \\ 3 & 1 & 3 & 1 & 3 \\ 0 & 1 & 1 & 3 & 1 \end{bmatrix}$$

2 **a** Explain the working of the following sharpening spatial domain filters. **[10]**

- The Laplacian
- Unsharp masking
- High boost filtering

b Perform Histogram Equalization for the following image. Show the original and equalized histogram. **[10]**

Intensity	0	1	2	3	4	5	6	7
No. of pixels	70	100	40	60	10	70	10	40

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3 **a** Write an expression for a two-dimensional DCT. Form a 4x4 DCT matrix and compute the DCT of the following sub-image. **[10]**

$$I = \begin{bmatrix} 1 & 2 & 2 & 1 \\ 2 & 1 & 2 & 1 \\ 1 & 2 & 2 & 1 \\ 2 & 1 & 2 & 1 \end{bmatrix}$$

b Compare Ideal, Butterworth and Gaussian Low Pass Filtering in frequency domain. **[10]**

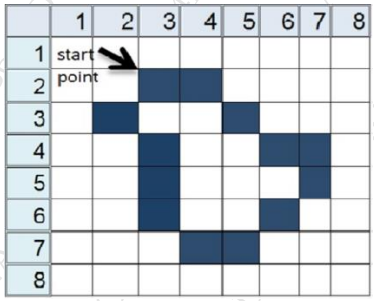
4 **a** Perform segmentation using split-and-merge technique on the following image. Show the quad-tree representation. **[10]**

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

b Explain morphological region filling. **[10]**

5 **a** Explain the working of Canny edge detector. **[10]**

b Find the chain code and shape number of the following shape. **[10]**



6 **a** Illustrate K-means algorithm for classification of data with a suitable example. **[10]**

b Explain the Support Vector Machine classifier for binary classification. **[10]**

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