(3Hours) [80 Marks]

N.B. 1) Question **No.1** is compulsory
2) Attempt any **Three** questions out of remaining.
3) Assume suitable data wherever necessary and state them clearly.

1 Answer the following:- (20)
(a) What do you understand by zero memory operation.
(b) Discuss different discontinuties in image.
(c) What is an Unitary matrix .
(d)Define Morphological operations Erosion and Dilation

2. (a) Discuss color models for a digital image. (10)

(b) For the given 3 bits per pixel, 4 × 4 size image perform following operations: (10)
(i) Intensity level slicing with background, $r_1 = 3$ and $r_2 = 5$
(ii) Bit plane slicing.

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

3. (a) Explain:The first difference makes the chain code invariant to rotation. (10)
(b) Explain Homomorphic filtering with the help of block diagram. (10)

4. (a) Write 8 × 8 Hadamard transform matrix and its signal flow graph for fast Hadamard transform. Using this butterfly diagram (Signal flow graph) compute Hadamard transform for $x(n) = \{1,2,1,1,3,2,1,2\}$ (10)

(b) Find the DCT of the given Image using matrix multiplication method. (10)

$$f(x,y) = \begin{bmatrix} 2 & 4 & 4 & 2 \\ 4 & 6 & 8 & 3 \\ 2 & 8 & 10 & 4 \\ 3 & 8 & 9 & 2 \end{bmatrix}$$

5. (a) Discuss the different types of redundancies in images with examples. (10)
(b) Construct Improved Gray Scale (IGS) quantization code for given gray scale data, (10)
{100, 110, 124, 124, 130, 200, 210} . Also Compute e_{rms} (root mean square error).

6. Write detail notes on (any Two) (20)
(a) Edge Linking using Hough transform
(b) Thinning with example.
(c) Differential Pusle Code Modulation (DPCM)
(d) Segmentation techniques: Region growing and split and merge.