(3 hours) **Marks:[80]**

N.B. 1. Question **No. 1** is compulsory
2. Attempt any **three** out of remaining
3. Assume suitable data if **necessary** and justify the assumptions
4. Figures to the **right** indicate full marks

Q.1. (a) Explain unitary matrix. [05]

(b) Explain opening and closing operations in terms of dilation and erosion. [05]

(c) Explain zero memory operations. [05]

(d) Explain fundamental steps in Image Processing. [05]

Q.2. (a) Explain DCT and its properties. Find the DCT for the following image [10]

2	0	1	0
1	1	0	1
1	0	0	1
2	1	2	3

(b) What are the different types of redundancies in digital image? Give methods to remove those redundancies. [10]

Q.3. (a) Explain global processing via graph theoretic technique. Find the optimal path for the following image. [10]

2	2	7
2	7	5
0	1	5

(b) What is image segmentation? Explain the principles of and differences among the three basic approaches to region growing, region splitting and merging and thresholding. [10]

Q.4. (a) A digital image with 8 quantization level is given below. Perform Histogram equalization. [10]

$f(x,y) = |x-y|$
for x=0 to 7
y=0 to 7

(b) Justify/contradict the following statement :- [10]

a) Enhancement process does not add any information to the image.

b) Shape number uniquely describes an object.

Q.5. (a) Find the Arithmetic codeword for the sequence a1a2a2a3a3 for the symbol a1 a2 and a3 with following frequencies : [10]

Source Symbol	Frequency
a1	0.2
a2	0.4
a3	0.4

(b) State & prove symmetry & periodicity property of DFT. Explain basic difference between DFT and DCT. [10]

Q.6. Write short notes on **(Any two)** [20]

a. Moments, Normalised moment and Central moments

b. Fidelity criteria

c. HSI color model

d. Edge linking using Hough transform