

- N.B.:** (1) Question No. 1 is compulsory.
 (2) Attempt any four out of remaining six questions.
 (3) Assume suitable data wherever necessary and state it.

1. State whether the following statements are true or false. Justify your answer. 20 (any four) :-

- (a) Median filter is used to remove salt and pepper noise.
- (b) Huffman coding is a loss less data compression technique.
- (c) Histogram of an image is its unique representation.
- (d) A high pass filter mask has the sum of its co-efficient as zero.
- (e) Averaging is a low pass filtering operation.

2. (a) (i) Perform histogram equalization on the gray level distribution of an image shown in the table. 6

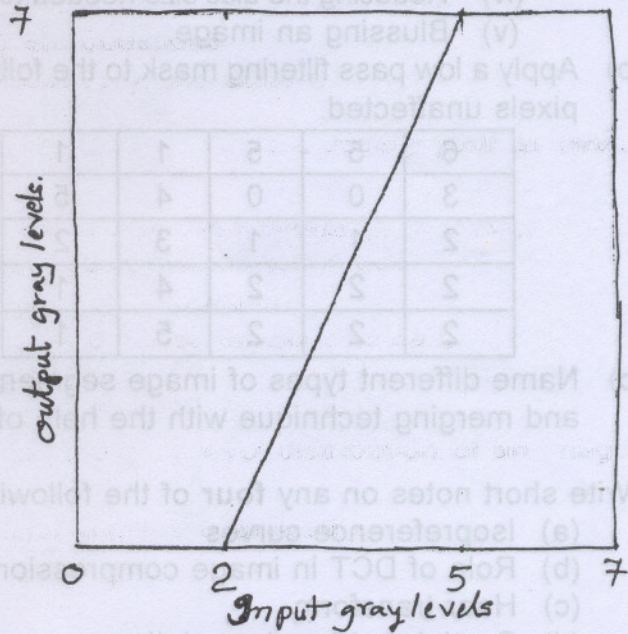
(ii) Draw the histograms of the original and the equalized images. 4

Gray Levels	0	1	2	3	4	5	6	7
No. of Pixels	100	250	100	300	150	0	0	0

(b) (i) An image segment with 3 bits per pixel is shown below. Perform contrast stretching as per the transfer function shown in the graph. 6

(ii) Draw the histograms of the original and the contrast stretched image segments. 4

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



3. (a) Apply FFT algorithm to the rows and columns of the image segment shown and obtain 2 DDFT. Show the Butterfly diagrams. 12

6	1	3	2
1	3	2	3
1	6	4	1
1	2	1	1

(b) State and prove the following properties for 2 DDFT and Hadamard transform :- 8

- (i) Linearity
- (ii) Kernel separability.

4. (a) Name and explain different types of redundancies in a digital image. 8
 Classify the following compression techniques in to lossy and loss less :— N.B.:
 (i) IGS coding (ii) Run length coding 2
 (iii) Transform coding (iv) DPCM coding. (3) Assume suitable
- (b) A source emits eight symbols with the probabilities given : — 10

Symbol	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8
Probability	0.1	0.4	0.05	0.05	0.1	0.2	0.07	0.03

Obtain the Huffman code and calculate entropy, average code word length and coding efficiency.

Explain why Huffman coding is not unique.

5. (a) Using Hough's transform, find the line passing through the maximum no. of points given below :— 10

(3,4), (0,-4), (1,4), (6,12), (4,1), (1.5,0), (-2,2), (-1,-3), (3,-2).

- (b) With the help of a block diagram, explain the working of a Homomorphic filter. 10

6. (a) Identify the image processing operations associated with the following applications :— 5

- (i) Displaying the Fourier transform of an image.
- (ii) Highlighting the watermasses in a satellite image of earth surface.
- (iii) Crispening the edges in an image.
- (iv) Reducing the disc size needed to store an image without affecting its quality.
- (v) Blussing an image.

- (b) Apply a low pass filtering mask to the following image segment. Leave the border pixels unaffected. 5

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

7	2	1	3	0	3	4
2	5	2	2	1	4	2
2	5	7	2	2	8	1
7	4	4	2	2	3	1
8	1	1	2	7	1	1
7	1	2	1	2	1	1
7	1	2	1	2	1	1

- (c) Name different types of image segmentation techniques. Explain the splitting and merging technique with the help of an example. 10

7. Write short notes on any **four** of the following :— 20

- (a) Isopreference curves
- (b) Role of DCT in image compression
- (c) Haar transform
- (d) Spatial and tonal resolution
- (e) Image differentiation.