

- N.B. (1) Question No. 1 is compulsory.
 (2) Answer any four out of remaining six questions.
 (3) Figures to the right indicate full marks.
 (4) Assume suitable data if necessary.

1. Justify/contradict following statements :-

- (a) If Kernel of an image transform is separable and symmetric, the transform can be expressed in matrix form. 20
 (b) All image compression techniques are invertible.
 (c) Chain codes can be made invariant to translation and rotation.
 (d) Median filter is best solution to remove salt and pepper noise.
 (e) Walsh transform is nothing but sequency ordered Hadamard matrix.

2. (a) A 64 x 64 image, represented by 8 bit/pixel has following Gray level distribution :- 10

| Gray Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------------|-----|----|-----|-----|-----|------|-----|-----|
| No. of Pixel | 128 | 75 | 280 | 416 | 635 | 1058 | 820 | 684 |

Perform Histogram equalization and give new distribution of gray level. Show plots of original and equalised image.

(b) Explain basic principles of detecting following in the images :- 10
 (i) Points (ii) Lines (iii) Edges.

Give 3 x 3 mask for each of them and explain their operation.

3. (a) Given below is the table of 8 symbols and their frequency of occurrence :- 10

| Symbol | S ₀ | S ₁ | S ₂ | S ₃ | S ₄ | S ₅ | S ₆ | S ₇ |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Frequency | 0.25 | 0.15 | 0.06 | 0.08 | 0.21 | 0.14 | 0.07 | 0.04 |

Give Huffman Code for each eight symbols.

- (b) Calculate Entropy of the source. 4
 (c) Find its average length. 3
 (d) Calculate efficiency of the code obtained in 3(a). 3

4. (a) Show that 2D-DCT of an image can be computed by row and column passes with 1D-DCT algorithm. 10

(b) For 2 x 2 transform A and the image U 10

$$A = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} ; U = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

Calculate transformed image V and the basis image.

5. (a) Explain the method of segmentation of images by region splitting and merging. 10

(b) Explain the following morphological operation in terms of dilation and erosion operations Hit or Miss, Open, Close, Boundary, Skeleton. 10

6. (a) Explain different types of color models and where they are used. How do convert colors from RGB to HSI model ? 10

(b) Assuming that edge starts in the first row and ends in the last row, for following gray-level image, sketch all possible paths and determine edge corresponding to minimum cost path. 10

| | | |
|---|---|---|
| 2 | 2 | 7 |
| 2 | 7 | 5 |
| 0 | 1 | 5 |

7. Write short notes on (any four) :- 20

- (a) Fourier descriptors
 (b) DPCM / DCT Encoder
 (c) 2D-wavelet transform filterbank
 (d) Image Compression Standard
 (e) Pseudocolor Image Processing.