

(REVISED COURSE)

(3 Hours)

[Total Marks : 100

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

1. State whether the following statements are TRUE or FALSE and justify your answer :— 20
 - (a) Image resulting from poor illumination could be difficult to segment.
 - (b) Median filter is the best solution to remove salt and pepper noise from the image.
 - (c) Walsh Transform matrix is nothing but the sequency ordered Hadamard matrix.
 - (d) Nonuniform sampling is not practical for an image of a dense crowd of people.
 - (e) The statement 'Runlength coding gives Data Compression' is not always true.

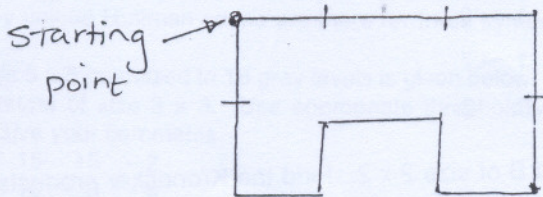
2. (a) Take the two images :— 8

$$I_1 = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \text{ and } I_2 = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

Obtain the transformed images I_{C_1} and I_{C_2} respectively using DCT. Use row and column operations only and show the images after each step.
 Give your comment on transformed images. 2

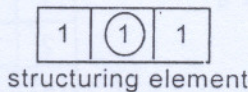
- (b) With neat block diagram explain the fundamental steps in digital image processing. Also 10
 discuss the elements required to implement these steps.

- 3. (a) Give the chain code, first difference, circular first difference, shape no. and order for the 10
 image given below. (4-Directions)



- (b) Perform 'Opening' and 'Closing' operation on the 5 x 5 size image given below. Write 10
 down the required equations/definitions and show the image after each step.

1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1



4. (a) Give the 3 x 3 mask/s suitable to detect— 10
 - (i) Horizontal edge
 - (ii) Points
 - (iii) Vertical line from the normal image and
 - (iv) Diagonal edges from the noisy image.

- (b) Apply Low pass filter and High pass filter on the central 3 x 3 pixels of the given image and obtain 3 x 3 output images. Using the output images, verify original = LP + HP. In case of discrepancy, explain the reasons. 10

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

- 5 (a) Generate Huffman code for the given image source. Calculate entropy of the source and rate, compression ratio, redundancy removed and efficiency of the code. 10

Intensity Level	0	1	2	3
Probability	0.4	0.3	0.2	0.1

- (b) Assuming that the edge starts on the first column and end in the last column, sketch all possible paths and determine the edge corresponding to minimum cost path. 10

k \ j →	0	1	2
0 ↓	2	1	0
1	1	1	7
2	6	8	2

- 6 (a) Take any two matrices A and B of size 2 x 2. Find the Kronecker products $A \otimes B$ and $B \otimes A$. Comment on your result. 6

- (b) Draw the butterfly diagram for Haar Transform of order N = 4. 4

- (c) For the 3 bit, 4 x 4 size image, perform the following operations :- 10

- (i) Negation.
- (ii) Thresholding with $T = 4$
- (iii) intensity level slicing with background with $r_1 = 2$ and $r_2 = 5$
- (iv) Bit plane slicing for MSB and LSB planes.
- (v) Clipping with $r_1 = 2$ and $r_2 = 5$.

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

- 7 Write the short notes on — (any four) 20

- (a) Connectivity of pixels.
- (b) Arithmetic Coding.
- (c) Fourier Descriptor.
- (d) RGB Colour Model.
- (e) Weber ratio.