B.E. INFORMATION TECHNOLOGY FOURTH YEAR SECOND SEMESTER - 2022

DIGITAL IMAGE PROCESSING

Time: Four Hours   Full Marks: 70

CO1

1. (a) Differentiate between binary image and gray scale image. What do you mean by $N_4(p)$, $N_D(p)$ and $N_8(p)$? What is digital path in an image? Explain with example

    (b) Write the algorithm to find out 8-connected component of binary image. Give an example.

    [5+5=10]

or

2. (a) If 1048576 number of bits require for a 8-bit gray scale image of size $512 \times m$. Find the value of m. What is dynamic range in a gray scale image?

    (b) Compute the three type of distance between P and Q in the image block as below

    (c) Define brightness, hue, saturation and chromaticity. How purest green and magenta can be presented in hexadecimal, when black and white are represented by 000000 and F F F F F F respectively.

    [2+3+5=10]

CO2

3. (a) What is the importance of image transformation?

    (b) Compute the Haar transform of the image block

5	10	15	11
7	10	15	5
5	11	11	8
4	10	9	5

    [2+8=10]

4. (a) When do we need digital image negative? What is bit plane slicing? What is weighted average filter? Illustrate with example.

(b) Perform Histogram equalization for given image block (gray scale [0,15]) in below and give the output image.

12	7	7	3	3	10
6	10	8	8	8	4
5	5	4	10	4	7
5	3	11	9	6	9
7	8	9	7	11	5
6	5	4	5	7	6

[5+10=15]

or

5. (a) What do you mean by bit plane slicing? Find all the bit planes of the following 4-bit image

8	12	9
11	10	6

(b) Calculate the first derivative and second derivative for the given image strip below

9 6 6 7 7 8 8 2 4 6 1 4 4 2 6 7 8 8 9 9

[7+8=15]

6. (a) Write the steps of basic global thresholding technique. Using basic global thresholding technique segment the following image in below.

| 2	2	1	6	8	8
1	2	1	8	8	8
2	2	2	2	6	7
1	3	3	7	6	7
3	1	3	2	7	6
1	2	6	7	8	8

Or

Find the edge map in the given image using the Sobel gradient operator and use $T = 20$ as the threshold for edge detection

9	9	9	9	9	9	9	2	2
9	8	9	9	9	9	2	2	2
9	9	9	9	9	9	3	2	2
9	9	9	9	9	2	2	2	2
7	9	9	9	9	2	2	2	2
9	9	9	9	2	2	2	2	2
9	9	9	9	2	2	2	4	2
9	9	9	2	2	2	2	2	2
9	9	2	2	2	2	1	2	2

(b) Define opening and closing morphological operation. Let f be gray scale image, and let b be a flat structuring element. What would happen if we erode f by b and dialte f by b?

[10+5=15]

CO5

7. (a) When external and internal representation are required? What is chain code? Determine the boundary chain code for given image based on 8-connectivity.
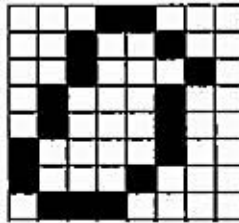
(b) What are the regional descriptors to describe a region?

[8+2=10]

CO6

8. (a) What is lossy and lossless image compression? What is fidelity criteria? Define BTC (block Truncation Coding) with example.

(b) Encode the following sequence "abdceb" using the arithmetic coding. The probability of each character is given below

Source Symbol	Probability	Initial subinterval
a	0.2	[0.0, 0.2)
b	0.2	[0.2, 0.4)
c	0.3	[0.4, 0.7)
d	0.1	[0.7, 0.8)
e	0.2	[0.8, 1.0)

Or

Encode the following sequence "abfcdec" using the huffman coding. The probability of each character is given below

Source Symbol	Probability
a	0.4
b	0.3
c	0.1
d	0.1
e	0.06
f	0.04

[4+6=10]

CO1: **Review** the fundamental concepts of digital image processing (K2)

CO2: **Analyze** images in the transform domain using different transforms like FT, DCT, HT, KLT, etc. (K3)

CO3 : **Demonstrate** the techniques for image enhancement. (K3)

CO4: **Illustrate** different techniques of Image segmentation including morphology. (K3)

CO5 : **Interpret** image-representation and description techniques. (K3)

CO6 : **Describe** and illustrate various image compression techniques. (K3)