B.E. INFORMATION TECHNOLOGY FOURTH YEAR FIRST SEMESTER EXAM 2019

IMAGE PROCESSING

Time: Three Hours   Full Marks: 100

Answer *One* question from each *CO #*

CO1
Answer any one from 1 and 2

1. (a) What is image and pixel? Differentiate between binary image and gray scale image.

    (b) Describe the fundamental steps of digital image processing with a neat and clean block diagram.

    (c) Define and explain sampling and quantization. What is the difference between nearest neighbor interpolation and bilinear interpolation in zooming technique

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

    3+6+6+5=20

or

2. (a) What is Image resolution? How many bits are required to store an 8-bit gray scale image of size 1024 × 1024? What is dynamic range in a gray scale image?

    (b) Define different type adjacency of pixel in digital images. Compute the three type of distance between P and Q in the image block as below

				Q	
	P				

    (c) What is color model? Describe the RGB color model with appropriate diagram.

    (d) 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 $FFFFFF$ respectively.

    4+6+5+5=20

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

(b) Compute the DCT (Discrete Cosine Transform) of the image block in the below

2	4	4	2
4	6	8	3
2	8	10	4
3	8	6	2

(c) Differentiate between DFT and WHT (Walsh-Hadamard Transform)

3+10+2=15

CO3
Answer any one from 4 and 5

4. (a) What is image enhancement? When do we need digital image negative? Describe the different type image enhancement technique in terms of inclusion of image pixel.

(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
```

(c) What is bit plane slicing? Derive the Laplacian mask or filter.

6+10+4=20

or

5. (a) Explain gray level slicing and contrast stretching.

(b) Define the histogram of an image. Why do we need local enhancement?

(c) When do we need smoothing filter? Differentiate between blurring and sharpening.

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

8	7	7	6	6	6	6	5	4	3	2	1	1	1	1	1	8	8	8	8

6+3+3+8=20

CO4

Answer any one from 6 and 7

6. (a) What is image segmentation? Define different types of image segmentation technique.

   (b) Find the edge map in the given image using the Robert gradient operator and use $T = 5$ 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

3+12=15

or

7. (a) Differentiate basic global thresholding and variable thresholding?

   (b) Write down the different types of line detection masks and explain their uses.

   (c) Write down the region growing algorithm for image segmentation. Define and explain region splitting and merging technique for segmentation.

2+6+7=15

CO5

8. (a) When external and internal representation are required? What is chain code? Determine the boundary chain code for given image based on 8-connectivity.
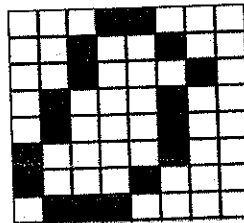
   (b) Describe different types of polygon approximation technique.

10+5=15

Answer 9(a) and any one from 9(b) and 9(c)

9. (a) What is fidelity criteria? Describe different types of redundancy in the image.

   (b) Encode the following sequence "aabccddeab" 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

   (c) Encode the following sequence "aabfcdeec" 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

5+10=15