C7-R4: DIGITAL IMAGE PROCESSING AND COMPUTER VISION

NOTE:

1.	**Answer question 1 and any FOUR from questions 2 to 7.**
2.	**Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours   **Total Marks: 100**

1.

a) Describe the following terms with respect to boundary extraction and irregular image processing: i) Bending energy ii) Total absolute curvature

b) How will image smoothing and sharping methods be useful during image enhancement process?

c) Draw only a block diagram of lossy encoding-decoding processes followed during image compression.

d) Define discrete cosine transform for $N \times N$ size images. How it is differ from the sine transform.

e) Write the basic four steps of edge detection to be performed sequentially during any image type data.

f) What do you mean by 'binary dilation' and 'binary erosion' in morphological image processing?

g) Discuss only features of Huffman coding technique to achieve lossless data compression.

(7x4)

2.

a) Apply Huffman coding technique and obtain optimum code for *a, b, c, d, e* for following image data

       A={*a*/20, *b*/15, *c*/5, *d*/15, *e*/45}

where, *a, b, c, d,* and *e,* are the alphabet and its frequency distribution.

b) Briefly discuss the basic properties of 2D Discrete Fourier Transform (DFT) and Frequency Fourier Transform (FFT). What is a significance of zero-padding in image data during FFT transformation?

c) Explain the use of Gaussian filtering technique in image enhancement.

(10+4+4)

3.

a) Explain the operation of Vector quantization (VQ) in JPEG standard. How do we generate the codebooks, which is one of the toughest parts of VQ? It is a lossy quantization method, Justify it.

b) Compute the equalized image with eight possible gray levels for following image data. Show each step of calculations with correct histograms of the original and equalized images. Also evaluate the equalized image after transformation steps.

1	2	1	1	2	0
0	1	5	1	0	1
1	6	7	6	1	2

(9+9)

4.

a) Discuss formulation for region based segmentation used to make partition of an image into region.

b) Briefly explain Cosine and Sine transforms for $N \times N$ image and also discuss their properties.

c) Find the number of bits to store a 128 x 128 image with 64 gray levels.

(8+6+4)

5.

a) Explain the basic operation of an active contour "Snakes" to approximate the perimeter of an object. Write only the expression of its energy function. Also, briefly note the entire procedure of finding contours in any image.

b) During colour image processing, what are the transformation steps required to follow for full color image processing? Explain each transformation process in their particular sequence.

(9+9)

6.

a) Discuss the dictionary based compression method namely, Lempel-Ziv-Welch (LZW) Algorithm. What are the main challenges associated with this method?

b) Most common image compression technique is "run length coding scheme". Explain the operational advantages of this method by taking some suitable examples.

(9+9)

7. Write **short notes** on:
a) Huffman coding technique: A lossless data compression
b) JPEG compression technique
c) Opening and Closing Operators in Morphological image processing

(6+6+6)