C7-R4: DIGITAL IMAGE PROCESSING & COMPUTER VISION

«QP_SRLNO»

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) Give properties of Discrete Fourier Transform through which the processes like image enhancement and restoration are possible.

b) What is difference between image sampling and image quantization?

c) Explain the operation of encoding and decoding in image compression with the help of only block diagrams.

d) Define the stereo correspondence problem in image formation and explain how do we solve the stereo correspondence problem?

e) Write main properties of Harr Wavelet transform method.

f) For each RGB image size of 8-bit, how many different shades of gray are possible in the RGB system? Give a possible solution to detect three different colors from available images through monochrome TV camera.

g) What are the limitations of gradient based edge detection technique used in the computer vision.

(7x4)

2.

a) How do you compute the Discrete Fourier Transform (DFT) for a given ***M*** **x** ***N*** size image? What are the problems associated while transforming any image in discrete domain?

b) Briefly explain the algorithmic steps used in Huffman coding during lossless data compression. What are the main features of Huffman compression method?

c) Gaussian filtering is usually a preferred averaging method. Why?

(6+6+6)

3.

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) Explain complete transformation steps for full color image processing and also write expressions for each transformation.

(9+9)

4.

a) Briefly explain the types of redundancy in image data using which major compression algorithms are developed.

b) In general, the discrete histogram equalization technique does not yield a flat histogram. Why?

c) How does the opening and closing operators are useful in morphological image processing?

(6+4+8)

5.

a) Why are the main steps that are required for edge detection in any image data?

b) Explain following descriptors for an irregularly shaped object in image processing.

i) Curvature

ii) Bending energy

iii) Total absolute curvature

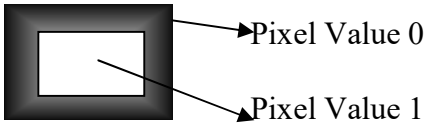
c) Explain the binary morphological operators namely Dilation and Erosion that related to describe or analyze the shape of a digital object.

(6+6+6)

6.

a) Explain the Lempel-Ziv-Welch (LZW) algorithm for compression and decompression image data.

b) Sketch the gradient of the below binary image,



and then consider the Sobel operators values as

$$H_y=\begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} \quad \& \quad H_x=\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

and use the approximation to compute gradient as, $g \approx |G_x| + |G_y|$. Find all relevant different values in the gradient image. With assumption of image size 128x128 pixels, sketch the histogram of edge directions from the above computation of gradient.

(9+9)

7. Write detailed notes on following (**any three**):

a) Discrete Cosine Transform (DCT): Features and Properties

b) Active contour model in computer vision

c) JPEG compression technique

d) Region oriented segmentation

(6+6+6)