

C7-R4: DIGITAL IMAGE PROCESSING & 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) Define digital image processing terms: (i) Image sampling and (ii) Quantization
 - b) What is significance of Image transformation? What are the applications of transformation in image processing?
 - c) In multi resolution processing, what are the properties of the Haar transform function?
 - d) What is run length coding? Give an example.
 - e) Briefly explain Hough transform technique to detect circle shape. Assume an equation for circle by $(x-a)^2 + (y-b)^2 = R^2$; where (a, b) is the centre of the circle and R is known radius.
 - f) What is the use of Opening and Closing operators in Morphological Image processing?
 - g) Give the basic formulae for Region-based segmentation, which illustrate its properties.

(7x4)

2.
 - a) Write a brief note on Vector Quantization.
 - b) Write algorithm steps to generate Huffman coding, which can be used for lossless data compression.
 - c) Draw a block diagram of general image compression system. What are the primary types of redundancy in image compression?

(6+6+6)

3.
 - a) How to compute the Discrete Fourier Transform (DFT) for an $M \times N$ size image? What are the problems associated in transformation of any image in discrete domain?
 - b) Why the contextual segmentation is more successful in separating individual objects in the image plane? What are the criteria for satisfying the "good" complete segmentation? Define the Pixel connectivity in image segmentation.

(9+9)

4.
 - a) Explain the main properties of the 2-D Discrete Fourier Transform.
 - b) What is the use of edge detection in computer vision? Write the equation to represent "strength" of an edge at each spatial location of an image $f[x,y]$.
 - c) Derive fundamental matrix say F , such that it gives the relationship between the corresponding image points in pixel coordinates. Assume all camera parameters are unknown.

(6+6+6)

5.
 - a) What is significance of a discrete cosine transform (DCT)? Write the equation for a forward DCT to represent the concept behind this transform coding.
 - b) For a given source $A = \{a_1, a_2, a_3, a_4\}$ the following codes were developed. Check for each of them whether it is uniquely decodable or not. Also state which is the most optimum compared to others? Why?
 - c) Determine a gray scale information function in Histogram equalization to create a uniform histogram.

(6+6+6)

6.

a) State and explain the features of median filtering. Complete the output of median filter in the following cases:

i) $x(n) = \{8 \ 2 \ 4 \ 3 \ 4\}$ and $w = \{-1 \ 0 \ 1\}$

ii) $x(n) = \{2 \ 4 \ 8 \ 3 \ 2\}$ and $w = \{-1 \ 0 \ 1 \ 2\}$

b) What is Stereo correspondence problem? How do we solve the stereo correspondence problem?

(9+9)

7.

a) Differentiate between "Spatial Resolutions versus Tonal Resolution".

b) Write a short note on any two of the followings:

i) Basic Morphological operations like Erosion and Dilation.

ii) Active Contour Mode

iii) General Methodologies used in Motion Estimation.

(6+12)