

BCSE 4th Year 1st Semester Examination, 2025

Image Processing

Full marks: 100

Time: 3 hours

Group A: CO1: Conceptualize the fundamentals of digital images [20 marks]

1. a) Describe the process of conversion from world co-ordinate to pixel co-ordinate in the context of digital image formation. 7
- b) 2-D Fourier transform is separable and symmetric – Explain. 4
- c) What are the properties of a distance metric? Define city-block distance and explain whether it is 4/8-distance. 5
- d) Explain point operation and neighborhood operation with suitable example. 4

Group B: CO2: Understand, analyze and apply the image enhancement techniques [20 marks]

Answer any one

2. a) What is image enhancement? 2
 - b) Write down the transformation function for histogram equalization and show that transformed variable will have uniform pdf. Write down the steps for histogram equalization for a digital image. 5+5
 - c) A 3x3 mean filter is convolved with itself. Find the output and discuss whether the output can be used for noise cleaning or not. 2.5+2.5
 - d) Find out the expression for the 2-D Laplacian operator and put it in kernel form. 3
3. a) Bilateral filter is edge preserving – Why? 4
 - b) What is weber's ratio? Obtain a transformation to map the intensity values of an image to perceivable levels. 2+6
 - c) Describe unsharp masking. 4
 - d) Write short note on Butterworth Low pass filter. Also specify the effect of its order. 4

Group C: CO3: Understand and apply the image analysis techniques [40 marks]

Answer any two

4. a) Compare first and second order derivative in the context of edge detection. 4
- b) Find out the expression for LOG. How can it be used for edge detection? 6
- c) In case of similarity based region extraction, discuss the desired conditions that the regions should satisfy. 4
- d) What is the purpose of OTSU algorithm? Deduce the expression to maximize. 6

5. a) What are the objectives of canny edge detection technique? What are the steps? Discuss the relevance of the steps towards fulfilling the objectives? 8
 b) In the context of segmentation what is the significance of super pixel? Describe the SLIC algorithm? 8
 c) Region splitting/merging should be followed by region formation. Why? Describe the region formation process. 4
6. a) An image contains two types of regions ideally having different intensity values. It is blurred and intensity histogram is flat. How can you make it bimodal? 4
 b) Write short notes on Hough transform. 6
 c) Define an isolated point and line. Write down the kernels for their detection. 5
 d) Why is edge linking required? Describe local edge linking method. 5

Group D: CO3: Understand and apply the image representation and description techniques [20 marks]

Answer any one

7. a) Given a binary image containing number of objects in the background. Object pixels are 1 and background pixels are 0. Write down the pseudo-code /code snippet in C language to find the number of objects. 5
 b) How will you make the chain code independent of starting point and independent of object rotation? 4
 c) How will you compute the centre of gravity of an object? 3
 d) In BTC compression how is a block represented? Find the compression ratio. 5
 e) Write short notes on LBP. 3
8. a) Explain the steps for computing HOG feature. 7
 b) Write short notes on medial axis transform. 4
 c) How will you convert from RGB to HSV model? 4
 d) What is the utility of chroma sub-sampling and zigzag scanning in JPEG compression? 5