

# CBCS SCHEME

USN

|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|

18CS741

## Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Digital Image Processing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Define Digital Image with a neat block diagram, explain the fundamental steps of image processing. (08 Marks)
- b. Explain the applications of Image processing. (06 Marks)
- c. Let p, q be the two pixels with coordinates (100, 120) and (130, 160) respectively. Compute:
- Euclidean distance
  - Chess board distance
  - Manhattan distance. (06 Marks)

OR

- 2 a. Explain the data structure for representing digital image. (08 Marks)
- b. Differentiate between sampling and quantization. (06 Marks)
- c. Find the shortest 4, 8 m-path between p and q consider  $v = \{0, 1\}$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|   | 3 | 1 | 2 | 1 | q |
|   | 2 | 2 | 0 | 2 |   |
|   | 1 | 2 | 1 | 1 |   |
| p | 1 | 0 | 1 | 1 |   |

(06 Marks)

### Module-2

- 3 a. Explain basic gray level transformation techniques. (08 Marks)
- b. Explain image smoothing spatial filter and sharpening spatial filter. (06 Marks)
- c. Apply logarithmic transformation on the input image by considering  $C = 1$ .

|     |     |    |
|-----|-----|----|
| 110 | 120 | 90 |
| 91  | 94  | 98 |
| 90  | 91  | 99 |

(06 Marks)

OR

- 4 a. Explain image enhancement using arithmetic and logic operations. (08 Marks)
- b. Explain image enhancement using first and second order derivatives. (06 Marks)
- c. Consider a gray scale image in matrix form. Let each element be a pixel of an image and values of the element represent intensities of the pixel. Perform Histogram equalization on the image and scale the intensity from 1 to 20.

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

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg,  $42+8 = 50$ , will be treated as malpractice.

**Module-3**

- 5 a. What is Sampling theorem? Explain sampling and Fourier transform of sampled function. (10 Marks)  
 b. State and explain properties of 2D Fourier transform function. (10 Marks)

OR

- 6 a. Explain the basic steps for filtering in the frequency domain. (10 Marks)  
 b. Explain Sharpening in the frequency domain using high pass filter. (10 Marks)

**Module-4**

- 7 a. What are the three basic objectives of canny edge detector? Explain canny edge detection algorithm. (08 Marks)  
 b. Explain point, edge and line detection techniques. (06 Marks)  
 c. Explain Mar-Hildreth edge detection algorithm in detail. (06 Marks)

OR

- 8 a. Optimal global thresholding can be achieved by Otsu's method. Justify the answer with an algorithm. (08 Marks)  
 b. Generate the Sobel and Prewitt masks for the matrix given below :

$$G_x = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} \quad G_y = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

- c. What is meant by edge linking? Explain edge linking using local processing. (06 Marks)

**Module-5**

- 9 a. Define Image Compression. Explain coding spatial and temporal redundancy. (06 Marks)  
 b. Using arithmetic coding, decode the message 0.572 given the coding model

| Symbol      | ↓   | C   | E   |
|-------------|-----|-----|-----|
| Probability | 0.1 | 0.4 | 0.5 |

- c. Explain Image, compression system with a neat diagram. (06 Marks)

OR

- 10 a. Explain Lempel-Ziv-Welch (LZW) coding with an example. (06 Marks)  
 b. The character a to h have the set of frequencies based on the first 8 Fibonacci numbers as follows :  
 a:1 b:1 c:2 d:3 e:5 f:8 g:13 h:21  
 A Huffman code is used to represent the characters. What is the sequence of characters corresponding to the following code (08 Marks)  
 110111100111010  
 c. Explain Run length coding with an example. (06 Marks)

\*\*\*\*\*