

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- VIII EXAMINATION-SUMMER 2023****Subject Code: 2181102****Date: 15/06/2023****Subject Name: Fundamentals of Image Processing****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1**
- (a) Digital image is obtained by sampling. This sampling process gives pixels in 1024 columns and 768 rows and quantized with 256 gray levels of each pixel. What is the memory required to store this image without any compression? **03**
- (b) List any four popular digital image file formats. Give brief explanation of each file format. **04**
- (c) Define connectivity. What is the difference between m-connectivity and 8-connectivity? Consider two pixels **p** and **q** whose coordinates are (0,0) and (6,3). Calculate D_e , D_4 and D_8 distances between pixels **p** and **q**. **07**

- Q.2**
- (a) What is the difference between image enhancement and image restoration? **03**
- (b) Explain the term “Mask” for spatial domain and frequency domain image processing operation. Write any one 3x3 mask for low pass filtering in spatial domain. **04**
- (c) What is the purpose of histogram equalization? Write steps for histogram equalization. Histogram calculation of one digital image is given below. Perform histogram equalization on it so that output image has all gray levels pixels from 0 to 7. **07**

Grey level	0	1	2	3	4	5	6	7
No. of pixels	20	30	40	50	60	0	0	0

OR

- (c) What is contrast stretching? Explain implementation algorithm of contrast stretching. Draw piece-wise linear input-output characteristics with corner points (0,0) (100,100) (150,200) (175,225) and (255,255). Determine the output for following input image. **07**

50	100	125	150
70	120	140	160
180	200	225	255
150	110	160	210

- Q.3**
- (a) What do you mean by unitary transform? Give any one example of unitary transform kernel. **03**
- (b) Show that “Multiplying the image with $-1^{(x+y)}$ in spatial domain” leads to shift of 2-D Fourier Transform to the centre. **04**

- (c) Compare lossy and loss-less image compression techniques. Explain LZW coding algorithm and apply LZW coding algorithm to compression the string “BABAABAAA” **07**

OR

- Q.3** (a) What is the need of applying transform on digital image in digital image processing? **03**
- (b) Find out DC Component of following 4x4 digital image **04**

$$\begin{bmatrix} 4 & 4 & 4 & 4 \\ 4 & 7 & 7 & 4 \\ 4 & 7 & 7 & 4 \\ 4 & 4 & 4 & 4 \end{bmatrix}$$

- (c) What is image compression? Why it is important? What is the reason of applying Discrete Cosine Transform or Discrete Wavelet Transform before Entropy coding for Image compression? **07**
- Q.4** (a) What is the difference between image convolution and correlation from image processing point of view. **03**
- (b) Consider following two 4x4 digital images I1 and I2. Perform XOR operation between I1 and I2 and write output image. **04**

$$I1 = \begin{bmatrix} 4 & 4 & 4 & 4 \\ 4 & 7 & 7 & 4 \\ 4 & 7 & 7 & 4 \\ 4 & 4 & 4 & 4 \end{bmatrix} \quad I2 = \begin{bmatrix} 4 & 4 & 4 & 4 \\ 4 & 3 & 3 & 4 \\ 4 & 3 & 3 & 4 \\ 4 & 4 & 4 & 4 \end{bmatrix}$$

- (c) Given digital image is having circular objects having diameter of 0.5 cm, square objects of the size 0.1x0.1 cm² and other small dots and some noise perturbations and random noise dots. If we want to keep only circular objects of the size 0.5 cm diameter in output image and want to remove all other perturbations, small dots and square objects, suggest suitable digital image processing method and explain it. **07**

OR

- Q.4** (a) Explain importance of morphological operations in digital image processing **03**
- (b) Consider following RGB triplets. Convert each triplet into CMY and YIQ **04**
- (i) (1 0 1) (ii) (1 1 1) (iii) (1 0 0)

- (c) Why second derivative operations are not much preferred for edge detection? What is “Laplacian of Gaussian(LOG)”? How it overcomes problem of Laplacian edge detection operator? **07**

- Q.5** (a) What is significance of image entropy? **03**
- (b) What is Gamma correction and why it is needed? **04**
- (c) What is image segmentation? What are the approaches used for image segmentation? Write 3x3 mask for horizontal line, vertical line and diagonal line edge detection. **07**

OR

- Q.5** (a) What is a structuring element in morphological operations? What are the criteria of deciding structuring element? **03**
- (b) Explain conversion of color image to gray scale image **04**
- (c) Explain Hough transform. What is the application of Hough transform? What problem occurs for vertical line? How it is solved? **07**
