

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII (NEW) EXAMINATION – WINTER 2023****Subject Code:2181102****Date:06-12-2023****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) List applications of digital image processing in Engineering and medical field. **03**
- (b) Explain the basic difference between point processing and mask processing. Generating negative image is point process or mask processing. **04**
- (c) Explain sampling and quantization process to generate digital image. How many bits per pixel require representing 256 grey levels? What is memory required to store image of size 1024 x 768 with 256 grey levels? **07**

- Q.2**
- (a) Compare and contrast smoothing and sharpening filter. **03**
- (b) What is salt and pepper noise and how does a median filter remove it? **04**
- (c) What do you mean by Histogram equalization? Equalize the given histogram. **07**

Gray value	0	1	2	3	4	5	6	7
Probability	790	1023	850	656	329	245	122	81

OR

- (c) What do you mean by bit plan slicing? Explain in brief. Consider the image given below. Obtain the new image if we set
- i) Lower order two bit plane to zero
 - ii) Higher order two bit plane to zero

12	13	14	15
4	5	6	7
8	9	10	11
0	1	3	2

- Q.3**
- (a) Explain low pass average filter in spatial domain with proper mask processing. **03**
- (b) Discuss frequency domain formulations of the unsharp masking with proper applications **04**
- (c) Explain the concept of frequency domain filtering and also explain and write expression for three kinds of low pass filters and high pass filters. **07**

OR

- Q.3**
- (a) Explain average filter to remove Gaussian noise in spatial domain for image smoothing purpose. What is the adverse effect of this filter? **03**
- (b) Briefly explain holomorphic filtering approach for image enhancement. **04**
- (c) “Multiplying the image with $(-1)^{(x+y)}$ in spatial domain leads to shift of 2D Fourier Transform to the center” Justify the statement with suitable example. **07**

- Q.4**
- (a) Explain noise probability function for Gaussian noise, Impulse noise and Salt and pepper noise. **03**
- (b) Explain Hit or Miss transformation in brief. **04**

- (c) Explain optimum global thresholding using Otsu's thresholding method for image segmentation. **07**

OR

- Q.4** (a) How 2D Discrete Fourier Transform is useful for image processing. Explain with the help of equation. **03**
- (b) Explain the model of image degradation /restoration process by means of block diagram. Explain each and every block **04**
- (c) Explain in detail canny edge detection algorithm for image segmentation process. Why Canny edge detector performance is superior compared to other edge detection techniques? **07**
- Q.5** (a) What do you mean by redundancy? What types of redundancies those can be identified and exploited for digital image compression purpose? **03**
- (b) What are lossless compression techniques? Derive Huffman code for encoding grey levels in image and find compression ratio

4	5	3	2
5	6	4	1
3	2	4	2
2	3	2	3

- (c) Explain dilation and erosion morphological operations with suitable example. **07**

OR

- Q.5** (a) What is color image processing? Write the expression for conversion of HSI to RGB color transformation. **03**
- (b) With the symbols and their probabilities of occurrence, encode the message "ACBA" using arithmetic coding algorithm. **04**

Symbol	A	B	C
Probability	0.8	0.02	0.18

- (c) What is first order and second order derivatives of an image? Why second order derivative is not much preferred for edge detection? How Laplacian of Gaussian (LoG) solves problem of second order derivative for edge detection? **07**
