Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2020

Subject Code:2171712 **Date:28/01/2021**

Subject Name:Image Processing

Time:10:30 AM TO 12:30 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** How correlation is useful for object matching ? **03**

(b) The following figure shows an 8-bit image of size 5 x 5, with x and y coordinates specified. **04**

x\ y->	**0**	**1**	**2**	**3**	**4**
0	170	160	20	55	90
1	220	210	60	65	55
2	120	25	89	81	145
3	235	255	84	55	180
4	250	220	70	50	170

Compute the following:

(i) The output of a 3 × 3 mean filter at (1,1). Write the filter mask?

(ii) The output of a 3 × 3 median filter at (2,1).

(c) The following figure shows an 8-bit input image (original) of size 4 x 4, with x and y coordinates specified. This image is to be displayed on CRT screen having value of gamma 2.5. **07**
What will be the displayed 4 x 4 output image on CRT screen ? What is the effect of gamma on output image?

x\ y->	**0**	**1**	**2**	**3**
0	120	150	250	85
1	100	150	75	75
2	200	255	88	88
3	250	154	120	76

(Hint: $s=c\, r^{gamma}$,c=1; pixel intensities should always be in 8-bit range)

Q.2 **(a)** What is the difference between lossy compression and lossless compression? **03**

(b) Compare the effects of ideal and Gaussian low pass filter on images in frequency domain with proper justification. **04**

(c) What do you mean by isotropic filters? Derive the filter mask of Laplacian which considers horizontal, vertical and diagonal directions. What is the use of this mask in image processing? **07**

Q.3 **(a)** Explain basic concepts of image sampling and quantization. **03**

(b) Find out storage requirements to store 50 true color images (24 bits per pixel) where each image has size of 512 x 512 pixels. **04**

(c) Explain periodic noise reduction in images by frequency domain filtering. Discuss a practical application of the same. **07**

Q.4 **(a)** What is hole filling algorithm? What is its application ? **03**

(b) With the help of necessary equations explain a simple image formation model. **04**

(c) Explain RGB and CMY color models, and their relationship. **07**

Q.5 **(a)** What is the use of thresholding in image segmentation ? **03**

(b) What is the advantage of morphology operation dilation over low pass filtering in binary images? **04**

(c) Given a 5x5 pixel image and respective pixel values (8-bit code for each pixel) below, (i) Calculate the respective Huffman codes for each symbol (each pixel value) of the given image, (ii) What is the compression ratio achieved by employing Huffman coding instead of 8-bit fixed length coding? **07**

180 160 160 140 120
110 110 120 140 120
110 140 120 120 140
120 160 160 170 170
170 120 110 140 110

Q.6 **(a)** List and discuss any one basic data redundancy in brief. **03**

(b) List various image processing steps involved in automatic license plate number detection of car. What are the challenges ? **04**

(c) Define dilation and erosion. For the binary image segment of size 4x4 and structuring element of size 3x3 shown below, find dilation and erosion outputs. **07**

1	1	1	0
1	1	1	1
1	1	1	0
1	1	1	1

1	1	1
1	1	1
1	1	1

Q.7 **(a)** Explain separability property of 2-D transform. **03**

(b) Discuss Bayes classifier for Gaussian pattern classes. **04**

(c) With the help of figures and equations discuss the role of illumination in histogram distortion. **07**

Q.8 **(a)** Find 2D convolution between x and h (x*h) shown below. **03**

x=

0	0	0	0	0
0	1	0	0	0
0	0	0	0	2
0	0	0	0	0
2	0	0	0	0

h=

1	2	3
4	5	6
7	8	9

(b) Discuss an application of image processing in process industries. **04**

(c) With the help of necessary equations and filter masks discuss various horizontal, vertical and diagonal edge detector operators in detail. **07**

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