Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015

Subject code: 714104N **Date: 17/12/2015**

Subject Name: Digital Image Processing and Applications

Time: 10:30 AM to 1:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What is an image? Explain the image formation model with suitable mathematics. Define the terms: Gray Scale, Resolution and Region in terms of an image. **07**

(b) What do you mean by adjacency? Define 4-, 8- and m-adjacency with suitable example. **07**

Q.2 **(a)** Explain Bit plane slicing operation in detail. **07**

(b) What do you mean by spatial filtering of an image? Explain the mathematical steps required in implementation of spatial filtering operation **07**

OR

(b) Define the Discrete Fourier Transform for a 2D Image. List out the properties of DFT. Explain the frequency shifting property of DFT in detail with suitable derivations. **07**

Q.3 **(a)** Suppose **"m"** be the gray-level of the input image, which has to be transformed to output image gray level **"l"** by histogram equalization technique. For an 8-level image of size 64 X 64, we have the following frequency table for the input gray levels. **07**

Gray level:	0	1	2	3	4	5	6	7
Frequency:	123	78	281	417	639	1054	816	688

Obtain the resultant gray level **"l"** using histogram equalization technique. Also plot the equalized histogram of the output image.

(b) Apply Laplacian mask of the size 3X 3 on the image shown in Fig. 1 below. Conclude about the result. **07**

3	3	8	3	3
3	8	15	8	3
8	15	20	15	8
3	8	15	8	3
3	3	8	3	3

Fig 1: 5X5 image

OR

Q.3 **(a)** Explain Minimum Mean Square Error Filtering with suitable mathematics. **07**

(b) Explain various noise models with suitable mathematics. Also explain the restoration techniques for noisy image. **07**

Q.4 **(a)** Consider the image segment **07**

128	128	128	64	64	32	32	8
64	64	128	128	128	8	32	32
32	8	64	128	128	64	64	64
8	128	128	64	64	8	64	64
128	64	64	64	128	128	8	8
64	64	64	128	128	128	32	32
8	128	32	64	64	128	128	128
8	8	64	64	128	128	64	64

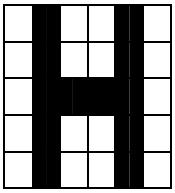
Based on the histogram, segment the image into two regions.

(b) What are the three stages of the canny edge detector? Briefly explain each phase. **07**

OR

Q.4 **(a)** Distinguish between image segmentation based on thresholding with image segmentation based on region-growing techniques. **07**

(b) Segment the image shown in figure below, using the split-and-merge procedure. Also show the quadtree corresponding to the segmentation. **07**



Q.5 **(a)** Explain Image Recognition operation in detail. **07**

(b) List out the various applications of Morphological operations. **07**

OR

Q.5 **(a)** Explain the morphological thinning algorithm in detail with suitable mathematical steps. **07**

(b) List out the various application area of image processing. Explain any one application in detail. **07**

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