Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

Date: 13/07/2012 Time : 02:30 pm To 5:00 pm

Subject code: 714104N

Subject Name: Digital Image Processing and Applications

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)** Elaborate the following terms with respect to image data **07**
(1)Spatial Resolution, (2) Gray level slicing,
(3) Thresholding, (4) Bit-plane slicing, (5) Sampling.

(b) Explain Histogram Equalization in detail with suitable example. **07**

Q.2 **(a)** Consider the following Figure 1, where each small rectangle represents a pixel and the value inside it is gray level at that pixel.Determine the new values of each pixels , if we apply **07**
(1) Median filter of 3X3
(2) Max filter of 3X3

0	1	0	6	7
2	0	1	6	5
1	1	7	5	6
1	0	6	6	5
2	5	6	7	6

Figure 1 : 5X5 image data

Use zero padding for filtering the boundary pixels.

(b) Write a short note on homomorphic filtering. Explain the advantages of homomorphic filtering with suitable derivations. **07**

OR

(b) Explain unsharp masking technique for image enhancement. **07**

Q.3 **(a)** Explain image restoration using constrained least square method. **07**

(b) In the image segment shown in Figure 2, compute the D4-, D8- and Dm distances between pixels p and q for V={0,1}. **07**

	3	1	2	1	0	q
	2	0	0	2	1	
	1	2	1	1	0	
	1	0	1	2	2	
p	1	2	3	2	0	

Figure 2 : Image segment of 5X5

OR

Q.3 **(a)** Explain inverse filtering method. Discuss the drawback and its solution of the inverse filtering method. **07**

(b) The basic approach used to approximate a discrete derivative involves taking difference of the form **07**

$f(x+1,y)-f(x,y)$.

1. Obtain the filter transfer function, H(u,v) for performing the equivalent process in the frequency domain.
2. Show that H(u,v) is a high pass filter.

Q.4 **(a)** The input binary image X, is shown in Figure 3, the image X is opened with the structuring element B. Show the resultant image. **07**

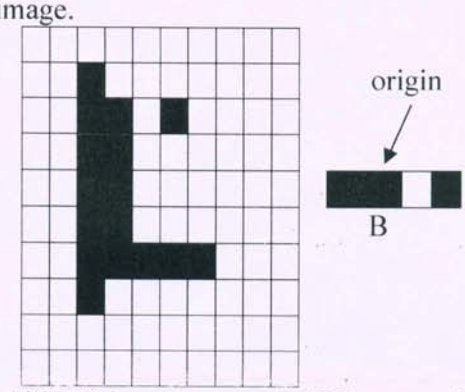

Fig 3: 10 X 10 image segment, 1X4 structuring element

(b) List out different applications of morphological operations, in the field of image processing. **07**

OR

Q.4 **(a)** What is an "edge" in an image? What are the three stages of the canny edge detector? Briefly explain each phase. **07**

Q.4 **(b)** Compare the canny edge detector with the laplacian of Gaussian edge detector. **07**

Q.5 **(a)** Explain the digital watermarking procedure in detail. **07**

(b) Write a short note on Hough transform. **07**

OR

Q.5 **(a)** List out the applications of image processing. Explain any one application of image processing in detail. **07**

(b) In a food industry sorting machine needs to measure the size of oranges coming on a conveyor belt and sort them in three different sizes of Large, Medium and Small. Image of a Large type of orange is shown in Figure 4. List down the steps to achieve the desired sorting. **07**

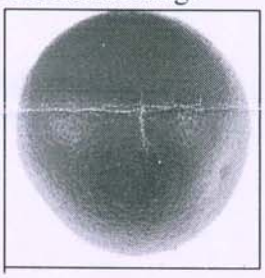

Figure 4: Image of an Orange

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