

**GUJARAT TECHNOLOGICAL UNIVERSITY****M. E. - SEMESTER – I • EXAMINATION – WINTER 2012****Subject code: 714104****Date: 16/01/2013****Subject Name: Digital Image Processing and Applications****Time: 02.30 pm – 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.

- Q.1 (a)** Explain the following with suitable example. **07**
1. 8-Connectivity.
  2. Euclidean Distance.
  3. Chess board distance
  4. City block distance

- (b)** For the image segment shown in Fig 1, compute the D4-, D8- and Dm- distances between pixels  $p$  and  $q$  for the set  $V=\{0,1\}$ . **07**

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

Fig 1: 4 X 4 image segment

- Q.2 (a)** Explain spatial filtering technique in detail. Apply the box filter on the input image shown in Fig 1. **07**
- (b)** Derive the 3 X 3 *Laplacian* mask for center pixel of the mask as  $f(x,y)$ . Show that the *Laplacian* mask is an Isotropic filter. **07**

**OR**

- (b)** Given histograms (a) and (b), modify histogram(a) as given by histogram (b) using histogram matching technique. **07**

Histogram (a)

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

Histogram (b)

Gray Value	0	1	2	3	4	5	6	7
Occurrence	0	0	0	614	819	1230	819	614

- Q.3 (a)** Explain Gaussian Low Pass filtering technique in frequency domain. Also list out the different applications of such filtering. **07**
- (b)** Compute the 2D DFT of the 4 X 4 image given in Fig 2. **07**

$$f(m,n)=$$

1	1	1	1
1	1	1	1
1	1	1	1
1	1	1	1

Fig 2: 4 X 4 image segment

**OR**

- Q.3 (a)** List down different types of noises which can be found in an image. How can we estimate mean and variance of a noisy image? Explain adaptive MMSE filter to remove the noise from the image. **07**

- (b) Explain the Convex Hull operation in detail with suitable mathematical equations. 07

- Q.4 (a) Using the input image and structuring element as given below in Fig 3, find the dilated version of the input image. 07

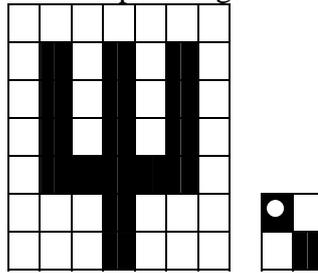


Fig 3: 7 X 7 Image Segment , Structuring Element

- (b) Apply the morphological opening operation on an input image for structuring element as shown in Fig 4. 07

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

0	1	0
1	⊖	1
0	1	0

Fig 4; 6 X 6 Image Segment , Structuring Element

OR

- Q.4 (a) Explain the simple Hough Transform technique of line detection. 07

- (b) Explain the *Laplacian of Gaussian (LoG)* and *Difference of Gaussian (DoG)* edge detection techniques in detail. 07

- Q.5 (a) Apply the *sobel* mask of the size 3 X 3 on the image shown in Fig 5 below. Conclude about the result.(Use zero padding for filtering the boundary pixels). 07

3	3	8	3	3
3	8	6	8	3
8	5	5	5	8
3	8	6	8	3
3	3	8	3	3

Fig 5: Image segment of 5 X 5

- (b) Explain the region splitting and merging technique for region based image segmentation with suitable example. 07

OR

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

- (b) Compare the *Canny* edge detector with the *Laplacian* edge detector. 07

\*\*\*\*\*