

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY****M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014****Subject code: 1710404****Date: 20-06-2014****Subject Name: Image Processing****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)** (1) Write different types of connectivity and give short mathematical description of each. Write different types of distance measures and give short mathematical description of each. **04**
- (2) Consider an image with 100 lines and 1000 pixels per line. Each pixel can take 256 different values. Calculate the total amount of bits needed to store that image. **03**
- (b)** By discussing the drawbacks of histogram equalization, explain histogram specification in brief. Perform the histogram specification for the 8x8 image shown in Table-1 **07**

Table-1

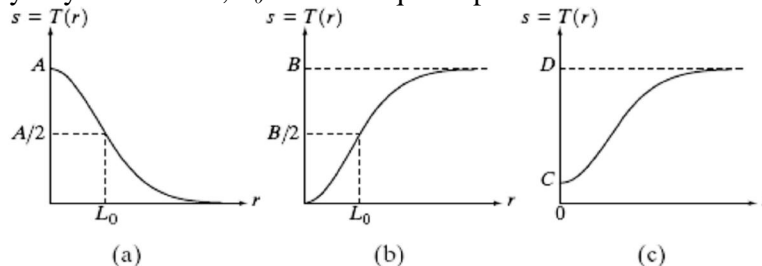
Grey level	0	1	2	3	4	5	6	7
Number of pixels	8	10	10	2	12	16	4	2

The target histogram is given as shown in Table-2

Table-2

Grey level	0	1	2	3	4	5	6	7
Number of pixels	0	0	0	0	20	20	16	8

- Q.2 (a)** Exponentials of the form with  $\alpha$ , a positive constant are useful for constructing smooth gray-level transformation functions. Start with this basic function and construct transformation functions having the general shapes shown in the following figures. The constants shown are input parameters, and your proposed transformations must include them in their specification. (For simplicity in your answers,  $L_0$  is not a required parameter in the third curve.) **07**



- (b)** Prove that for Laplacian Operation using  $\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$  is isotropic for **07**

equations shown below relating coordinates after axis rotation by an angle

$$x = x' \cos \theta - y' \sin \theta$$

$$y = x' \sin \theta + y' \cos \theta$$

Where  $(x, y)$  are the unrotated and  $(x', y')$  are the rotated coordinates.

**OR**

- (b) Consider the following 4x4 image. Apply the linear smoothing filters like Average and Weighted average as well as non-linear smoothing filter like median filter. (Apply zero padding for your analysis) 07

13	5	11	6
15	4	6	7
12	14	4	10
10	12	5	11

Give comments on result you obtained.

- Q.3** (a) Explain the difference between image restoration and image enhancement. Also highlight the process of image restoration. Explain Wiener filtering in brief and compare it with Inverse filtering. 07
- (b) Explain (1) homomorphic filter and (2) Gaussian high pass filter in frequency domain. 07

**OR**

- Q.3** (a) A continuous Gaussian low pass filter in the continuous frequency domain has the transfer function 07

$$H(u, v) = A \exp\left(-\frac{u^2 + v^2}{2\sigma^2}\right)$$

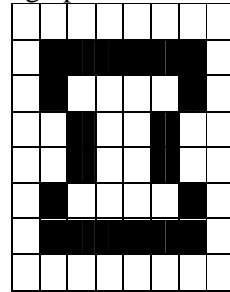
Show that corresponding filter in spatial domain is

$$h(t, z) = A \cdot 2\pi \sigma^2 \exp\left(-2\pi^2 \sigma^2 (t^2 + z^2)\right)$$

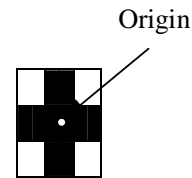
- (b) Why is it necessary to shift fourier transform component  $F(0,0)$  at  $F(M/2, N/2)$ ? Explain how you can achieve it. 07
- Q.4** (a) Prove the validity of the following expressions: 07
- (1)  $A \circ B$  is subset of  $A$
  - (2) If  $C$  is subset of  $D$ , then  $C \circ B$  is a subset of  $D \circ B$
  - (3)  $(A \circ B) \circ B = A \circ B$
- (b) (1) Explain Hit or Miss transform operation 04
- (2) Enlist the steps to perform JPEG compression standard. 03

**OR**

- Q.4** (a) For the input image and structuring element shown in figure, perform the region filling operation. 07



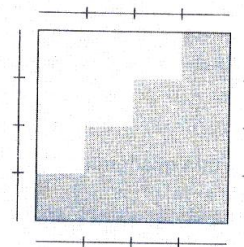
Image



Structuring Element

- (b) Explain concept of edge linking using Hough transform. 07

- Q.5** (a) Show that average value of Laplacian of Gaussian operator,  $\nabla^2 G(x, y)$  is zero. 07
- (b) Apply the split and merge technique to segment the image shown in figure 07



**OR**

- Q.5** (a) Explain different thresholding techniques with respect to Image segmentation. **07**  
What is the role of noise illumination and reflectance for the same. Also explain the concept of otsu's binarization with necessary derivation.
- (b) (1) Explain the concept of chain codes and difference chain codes used to represent the boundary by straight lines **07**

\*\*\*\*\*