Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –II Examination Dec. - 2011

Subject code: 1710404 **Date: 16/12/2011**

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)** The probability distribution of an 8-level image is specified under two contrast conditions by two histograms A and B as given below. **07**

Histogram A:

Pr(0)=0, Pr(1)=Pr(2)=0.1,Pr(3)=0.3, Pr(4)=Pr(5)=0, Pr(6)=0.4, Pr(7)=0.1

Histogram B:

Pz(0)=0, Pz(1)=0.1, Pz(2)=0.2, Pz(3)=0.4, Pz(4)=0.2, Pz(5)=0.1, Pz(6)=Pz(7)=0

Find the transformation between r and z

(b) Consider the image segment shown in below figure **07**

(i) Let V={0,1} and compute the lengths of the shortest 4-,8- and m-path between p and q

(ii) Repeat for V={1,2}

3	1	2	1 (q)
2	2	0	2
1	2	1	1
1 (p)	0	1	2

Q.2 **(a)** **07**

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 equations shown below relating coordinates after axis rotation by an angle θ

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

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

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

(b) An image has the gray level PDF Pr(r) shown in figure (1). It is desired to transform the gray levels of his images so that they will have the specified Pz(z) shown. Assume continuous quantities and find the transformation in terms of *r* and *z* that will accomplish this. **07**

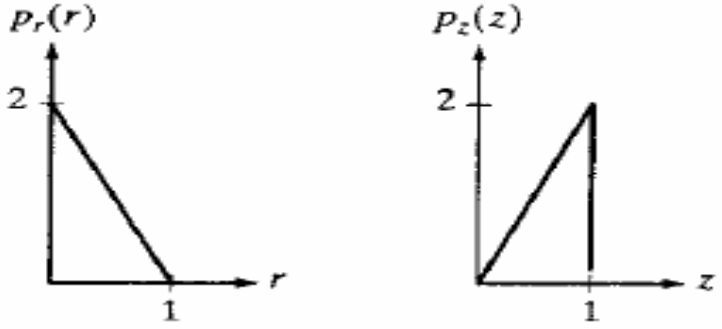

Figure 1

OR

(b) Explain Wiener filtering for removal of blur in image. **07**

Q.3 **(a)** Explain homomorphic filtering in detail. **07**

(b) Prove that $\nabla^2 f(x,y) \Leftrightarrow -(u^2+v^2)F(u,v)$ **07**

OR

Q.3 **(a)** Define a model of Image restoration. Also explain the different noise Probability Density functions. **07**

(b) Explain the following terms: (1) JPEG 2000 (2) MPEG Standard. **07**

Q.4 **(a)** Explain the Hit or Miss transformation. **07**

(b) Explain the region filling and boundary extraction morphological algorithm. **07**

OR

Q.4 **(a)** (i) Show that the definition of dilation **07**

$$A \oplus B = \{w \in Z^2 \mid w = a + b, \text{ for some } a \in A \text{ and } b \in B\}$$

is equivalent to

$$A \oplus B = \bigcup_{b \in B} (A)_b$$

(ii) Show that another definition of dilation

$$A \oplus B = \{w \in Z^2 \mid (\hat{B})_w \bigcap A \neq \Phi\}$$

is also equivalent to

$$A \oplus B = \bigcup_{b \in B} (A)_b$$

Q.4 **(b)** What do you meant by Color model? List the application of each color model. Explain any one color model in brief. **07**

Q.5 **(a)** What is the advantage of using Sobel operator? Explain the process of edge detection using gradient operators. **07**

(b) Explain the concept of Laplacian and LoG for edge detection and comment on comparison of both the operators. **07**

OR

Q.5 **(a)** Explain the concept of edge linking using Hough transform. **07**

(b) Explain the concept of thresholding in image segmentation and two methods of thresholding in brief. **07**

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