Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 720104 **Subject Name: Digital Image Processing**

Date: 07 /07 /2010 **Time: 11.00am – 1.30pm**

Total Marks: 60

Instructions:

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

Q.1 **(a)** Briefly explain sampling and quantization processes to create digital image. Mention the names of energy sources used to acquire digital images. Briefly explain the digital images categorization and applications based on their energy sources. **06**

(b) Pixels values of 5X5 image are as under **06**

90	120	140	125	140
130	10	100	150	200
95	30	45	170	135
60	250	65	5	180
70	40	90	145	200

(1) Apply median filter (3x3) on original image and find out pixels values for new image

(2) Plot histogram for the given image

Q.2 **(a)** Prove that **06**

F(f(x) * g(x))=F(x)G(x) i.e. convolution in spatial domain is same as multiplication in frequency domain .

(b) Explain inverse filtering for image restoration. In what conditions the inverse filtering cannot recover the undegraded image even if the degradation function is known **06**

OR

(b) Briefly explain a model of image degradation process. Also give the equations both for spatial and frequency domain. **06**

Q.3 **(a)** An image with intensities in the range [0 L-1] has the PDF $p_r(r)$ as **06**

$p_r(r)=2*r/(L-1)^2$ for $0<=r<=L-1$

$=0$ otherwise

What is the transformation function you would use for histogram equalization?

(b) Briefly explain segmentation with local threshold using Laplacian and Gradient operators. **06**

OR

Q.3 **(a)** Define Local thresholding, Global Thresholding and Dynamic or adaptive Thresholding. Also explain the algorithm to determine global thresholding. **06**

(b) Prove that opening and closing are duals of each other. **06**

Q.4 **(a)** Briefly explain Dilation and Erosion as **06**

(1)Boundary extractor (2) Hole filling (3) Connected component extractor

(b) Let gray level probability density functions of two regions in an image are **06**

$p_1(z)=A_1\exp[-(z-m_1)^2/2\sigma_1^2]$

$p_2(z)=A_2\exp[-(z-m_2)^2/2\,\sigma_2^2]$

Prove that optimal threshold $T=(m_1+m_2)/2$ when probability of occurrence of pixels of both regions are equal

Derive necessary equations.

OR

Q.4 **(a)** Define opening and closing morphological operators with their applications **06**

(b) Briefly explain Pseudocolor and Full color image processing **06**

Q.5 **(a)** Briefly explain Fourier descriptor to describe boundary of a region. "Fourier descriptor is almost insensitive to translation, rotation and scaling." Justify the statement. **06**

(b) How is the principle component analysis used for a region description? **06**

OR

Q.5 **(a)** What is a minimum distance classifier? Derive an equation for it **06**

(b) With block diagram explain JPEG image compression standard **06**

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