Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – II[nd] - Examination – June/July- 2011

Subject code: 1720104

Subject Name: Digital Image Processing

Date:27/06/2011 **Time: 10:30 am – 01:00 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 process of image capture and digital conversion of gray scale images. Explain the meaning of MxN size and 8-bit gray-scale image. **07**

(b) Explain piece-wise linear and non-linear intensity transformations. **07**

Q.2 **(a)** Explain how the linear filtering of an image is performed through convolution-mask. Find the result of smoothing operation of the following image block of size 3x3 through an averaging mask of size 2x2. **07**

000	010	020
010	240	010
020	010	000

(b) Explain how averaging over multiple image observations helps to suppress the zero-mean additive white noise with a constant variance. How the amount of noise suppression is dependent of the number of observations? **07**

OR

(b) Explain why the gradient and Laplacian are useful in edge detection in images and how they are implemented on digital images. **07**

Q.3 **(a)** Explain histogram equalization and matching. Why is it not perfect for digital images? **07**

(b) Explain the application of order statistic filters in removal of impulsive noise. Find the result of min, median, and max filters of size 3x3, for the center pixel of the following image block of size 3x3. **07**

100	130	120
070	250	110
090	080	060

OR

Q.3 **(a)** Give the equations for DFT (discrete Fourier transform) and inverse DFT for images and based on these equations show that the reconstruction is perfect (or lossless). **07**

(b) State the convolution theorem for DFT for images. Explain the application of this theorem in implementation of linear filtering of images in spectral domain, giving a suitable example. **07**

Q.4	**(a)**	Explain how the ideal low-pass, high-pass, band-pass and band-reject filters are implemented in spectral domain. Explain the reason for ringing effect in the result image.	**07**
	(b)	Explain how Gaussian and Butterworth types of low-pass and high-pass filters are implemented in spectral domain for digital images.	**07**

OR

Q.4	**(a)**	Explain the objective of homomorphic filtering and its implementation.	**07**
	(b)	Explain basic morphological operations with their applications in digital image processing.	**07**
Q.5	**(a)**	Explain the phrase AWGN (Additive White Gaussian Noise) with it main features and characteristics with relevant equations.	**07**
	(b)	Explain the following fundamentals of image compression: Compression ratio, types of redundancy, source encoding, channel encoding.	**07**

OR

Q.5	**(a)**	Explain each of the components of the following color models: RGB (Red-Green-Blue), CMY (Cyan-Magenta-Yellow) and HSI (Hue-Saturation-Intensity). State where these color models are applied primarily.	**07**
	(b)	Explain the multi-resolution analysis of images giving a block diagram of its implementation. Explain the relationship of the detail and approximation coefficients at various levels and the corresponding signal spaces.	**07**

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