

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-II Examination July 2010****Subject code: 710404****Subject Name: 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) What is digital image processing? What are the principal application areas that create interest in digital image processing? Discuss applications of image processing. **06**

- (b)** i) How a digital image is represented? Explain 2-D sampling theory in brief. **06**
 ii) Define Spatial and Intensity resolution. How these two parameters interact in determining perceived image quality? What is false contouring?

Q.2 (a) i) Explain basic relationships between pixels. **06**
 ii) What is image enhancement? Compare spatial domain and frequency domain enhancement methods.

- (b)** i) Define Hadamard transform and obtain the Hadamard matrix for $n=3$. **06**
 ii) Give properties of Haar transform and compare it with KL transform.
 iii) Justify that KLT is an optimal transform.

OR

- (b)** i) Define Point processing and Mask processing. **06**
 ii) Explain Power-Law transformations. What is gamma correction?
 iii) What is bit-plane slicing? What effect would setting to zero the lower-order bit planes have on the histogram of an image in general? What would be the effect on the histogram if we set to zero the higher-order bit planes instead?

Q.3 (a) i) What is contrast stretching? Draw the histogram for bright image and low contrast image. **06**
 ii) What is gray-level slicing?
 iii) Give the steps for histogram specification technique.

- (b)** Explain histogram equalization technique for image enhancement in brief. **06**
 The intensity distribution of a 3-bit image of size 64×64 pixels is given below:

r_k	r_0	r_1	r_2	r_3	r_4	r_5	r_6	r_7
n_k	790	1023	850	656	329	245	122	81

Where r_k is a K^{th} intensity level & n_k is the number of pixels that have intensity level r_k . The image has integer intensity levels in the range $[0, 7]$. Equalize the histogram of the image.

OR

Q.3 (a) i) What is image smoothening? Explain smoothing spatial filters. **06**

- ii) Define unsharp masking and high-boost filtering. **06**
- (b)** i) Explain Discrete Cosine Transform in brief. **06**
 ii) List out the properties of 2-D DFT.
- Q.4 (a)** i) Explain Homomorphic filtering for image enhancement in detail. **06**
 ii) Write the basic steps for filtering an image in frequency domain.
- (b)** i) Prove that $(-1)^{x+y} f(x, y) \Leftrightarrow F(u - M/2, v - N/2)$. **06**
 ii) Prove that $\nabla^2 f(x, y) \Leftrightarrow -(u^2 + v^2)F(u, v)$.
 iii) Suppose that you form a low pass spatial filter that averages the four immediate neighbors of point (x,y) but excludes point itself. Find equivalent filter H(u,v) in the frequency domain.
- OR**
- Q.4 (a)** i) What is image restoration? Differentiate image restoration and image enhancement. **06**
 ii) Explain Wiener filtering in brief and compare it with Inverse filtering.
- (b)** i) What do you mean by Color model? List the application of each color model. Explain any one color model in brief. **06**
 ii) Define Full color and Pseudo color processing.
- Q.5 (a)** i) What are the basic steps in JPEG? Compare MPEG standard with JPEG. **06**
 ii) Explain morphological Hit-or-Miss transform for shape detection.
- (b)** i) Explain the structure of H.26x standard. **06**
 ii) Explain Dilation and Erosion operations for morphological processing.
- OR**
- Q.5 (a)** i) Name the approaches used to describe the texture of a region. **06**
 ii) How edge detection is used for detecting discontinuities in digital image? Explain edge detection using Laplacian operator.
 iii) What is the advantage of using Sobel operator? Explain the process of edge detection using gradient operators.
- (b)** i) Explain edge linking using Hough transform. **06**
 ii) Explain the concept of thresholding in image segmentation.
 iii) What are circulant matrices?
