(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2716 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2013-14

DIGITAL IMAGE PROCESSING

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions.

1. Attempt any **four** parts of the following : **(5×4=20)**

   (a) Describe in detail the elements of digital image processing system and describe Sampling and Quantization.

   (b) Explain the properties of images which can be described by histogram. Also explain Normalized Histogram.

   (c) Explain histogram matching. Perform the histogram equalization for 8×8 image shown below :

Gray levels	0	1	2	3	4	5	6	7
No. of pixels	9	8	11	4	10	15	4	3

   (d) Explain the 4, 8 and m connectivity of pixels. Explain region, edge in context with connectivity of pixels.

   (e) Explain the need of Histogram Matching (specification). Deduce the formula for Histogram Matching.

(f) The following matrix defines a 5×5 image f(x,y). Suppose smoothing is done to the image using 3×3 neighbourhood in the spatial domain. Then what will be the new value of f(2,2) using the :

(i) Mean filter

(ii) Max filter

(iii) Median filter

(iv) Min filter.

2	3	2	4	5
1	3	5	4	5
2	1	2	7	6
3	6	5	6	4
3	5	6	4	7

2. Attempt any **four** parts of the following : **(5×4=20)**

(a) Discuss Image smoothing with the following :

(i) Low pass spatial filtering

(ii) Median filtering.

(b) Distinguish between spatial domain techniques and frequency domain techniques of image enhancement.

(c) An image segment is shown below. Let V be the set of gray level values used to define connectivity in the image. Compute D4, D8 and Dm distances between pixel

p and q for :

(i) $v = \{2,3\}$

(ii) $v = \{2,6\}$.

P

2	3	2	6	1
6	2	3	6	2
5	3	2	3	5
2	4	3	5	2
4	5	2	3	6

q

(d) Consider a 3×3 spatial mask that averages the four closet neighbours of a point (x,y), but excludes the point itself from the average.

(i) Find the equivalent filter, H(u,v) in the frequency domain.

(ii) Show that your result is low pass filter.

(e) Find the equivalent filter H(u,v), that implements in the frequency domain the spatial operation performed by the laplacian mask.

(f) Prove that 2-D continuous and discrete Fourier transforms are linear operations.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) Explain Image degradation/Restoration Process. Explain all noises with their PDF.

(b) Explain why Band Rejects filters are best suitable for reducing Periodic noise. Explain all Band Reject filters in detail. Obtain corresponding expression for Band pass filters.

(c) Explain the following :

(i) Wiener filter with SNR, MSE ratio for spatial and frequency domain

(ii) Local noise reduction adaptive filter.

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) Explain morphological image processing in context with set theory. Explain erosion, dilation, opening and closing with proper example.

(b) Prove the following properties :

(i) $(A \cdot B)^c = (A^c \circ B\hat{})$ and $(A \circ B)^C = (A^c \cdot B\hat{})$

(ii) $(A \circ B) \circ B = A \circ B$ and $(A \cdot B) \cdot B = A \cdot B$

(c) Explain the following Morphological Algorithms :

(i) Thinning

(ii) Thickening

(iii) Convex Hull

(iv) Extraction of Connected Components

(v) Region Filling.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) How many degrees of freedom are there in a plane projective transformation ? Name the properties preserved under such transformation. Explain Projective and Affine transformation.

(b) Discuss parametric and non-parametric methods in optimal thresholding algorithms. Discuss Region Growing Approach. Also explain split and merge algorithm with Quadtree.

(c) Discuss various Edge detectors in detail. What is Image Registration ? Explain stereo imaging in detail.