



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

**PAPER ID : 110702**

Roll No.

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**B.Tech.**

(SEM. VII) (ODD SEM.) THEORY

EXAMINATION, 2014-15

**DIGITAL IMAGE PROCESSING**

Time : 3 Hours]

[Total Marks : 100

**Note :** Attempt all questions.

- 1 Attempt any **four** parts of the following : (5×4=20)
- What is Digital Image Processing ? Discuss some of its major applications.
  - Consider two image subsets  $S_1$  &  $S_2$  as shown in the following figure. For  $V=\{0\}$  determine whether the regions are: i) 4-Adjacent ii) 8-Adjacent iii) m-Adjacent. Give reasons for your answer.

$S_1$				$S_2$			
1	1	1	1	1	1	0	0
1	1	0	1	1	0	1	1
1	1	0	1	0	0	1	1
1	0	0	0	1	1	1	1

- c. Write short notes on :
- Sampling and Quantization
  - Homomorphic filtering.
- d. Given  $h(u, v)$  as follows, discuss its frequency response.

	$\frac{1}{6}$	
$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{6}$
	$\frac{1}{6}$	

- e. Find the DFT of  $f(x) = \{0, 1, 2, 1\}$ .

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

- a. What is Bit-plane Slicing ? Given the following 3×3 image, find its bit planes.

1	2	3
4	5	0
7	2	1

- b. Write short notes on the following :

- Gamma correction
- Piece-wise linear transformation.

- c. Consider the following image. What will be the new value of the pixel (2, 2) if smoothing is done using a 3×3 :

0	1	0	2	7
2	7	7	4	0
5	6	4	3	3
1	1	0	7	5
5	4	2	2	5

- Mean filter
- Weighted average filter
- Median filter
- Min filter
- Max filter.

- d. Briefly explain the working of a Laplacian mask. What will be the effect of applying the filter (a) on the image (b) ?

1	1	1
1	-8	1
1	1	1

50	50	50	50	50	50
50	50	50	50	50	50
50	50	50	50	50	50
100	100	100	100	100	100
100	100	100	100	100	100
100	100	100	100	100	100

(a)

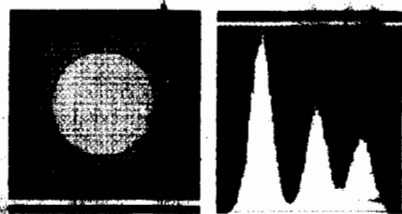
(b)

- e. Perform histogram equalization on the following  $8 \times 8$  image. The gray level distribution of the image is given below :

Gray levels ( $n_k$ )	0	1	2	3	4	5	6	7
Number of pixels ( $p_k$ )	8	10	10	2	12	16	4	2

3 Attempt any four parts of the following : (5×4=20)

- a. In an image the gray scale spans from black to near white in only three increments. A certain noise has corrupted the image. The image and its histogram are as follows. What type of mean filters can you use to eliminate the noise? Explain.

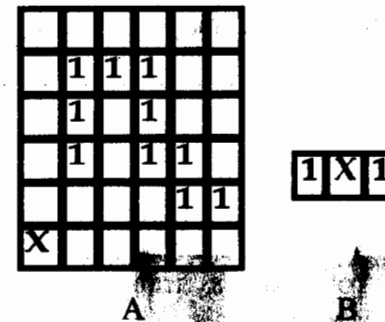


- b. Give a model for image Degradation/Restoration Process.

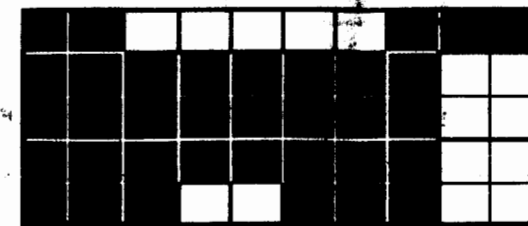
- c. What is the difference between image enhancement and image restoration ? Mention some important causes of image degradation.
- d. Explain any two noise models in detail.
- e. What are order-statistic filters ?

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

- a. Let A be an image and B a structuring element, given as follows. Find  $A \oplus B$  and  $A \ominus B$ . Note: X denotes the origin, which is not part of the structuring element.



- b. Thin the following image. Show the image after each step.



- c. Extract the connected component from the following image.

0	0	0	0	0	0	0	0	0
0	0	1	1	1	0	0	0	0
0	0	1	1	0	1	1	0	0
0	1	1	1	1	1	1	1	0
0	1	1	1	0	1	1	0	0
0	0	0	0	0	0	0	0	0

- d. Explain the procedure of Region Filling with an example.
- e. Prove that Opening and Closing are Dual Transformations.

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

- a. Prove that rotation and translation are not commutative operations.
- b. What is shearing? Give the transformation matrix and its inverse to carry out shearing in both x- and y-directions with shearing factors 10 and 30.

- c. Find a matrix to perform the following transformations to an object:
- Scale in the x-direction using a scale factor 10.
  - Followed by a rotation about z-axis 30 degree
- d. Explain the process of image segmentation using region growing.
- e. Describe the technique of thresholding for image segmentation.