



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (CSE) (Separate Supple)/SEM-7/CS-704G/2011

2011

IMAGE PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

$$10 \times 1 = 10$$

- i) When no a priori model of the degradation model is available, the quality of an image is improved by
 - a) Image compression b) Image restoration
 - c) Image normalization d) Image enhancement.
- ii) If the components of the image histogram are concentrated on the low side of the gray scale, then the image is a
 - a) High contrast image b) Low contrast image
 - c) Dark image d) Bright image.
- iii) Which is used to detect the presence of an edge at a point in an image ?
 - a) Sign of first derivative
 - b) Magnitude of first derivative
 - c) Magnitude of second derivative
 - d) Sign of second derivative.



x) When the Fourier spectrum of noise is constant, the noise is called

- a) Gaussian noise b) White noise
c) Salt-and-pepper noise d) Gamma noise.

GROUP – B

(Short Answer Type Questions)

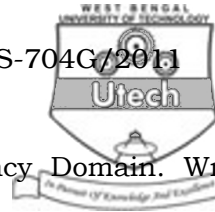
Answer any *three* of the following. $3 \times 5 = 15$

2. Consider the image segment shown.

Let $V = \{ 0, 1 \}$ and compute the lengths of the shortest 4-, 8-, and m -path between p and q . If a particular path does not exist between these two points, explain why.

	3	1	2	1	(q)
	2	2	0	2	
	1	2	1	1	
(p)	1	0	1	2	

3. With the help of degradation model explain the restoration process of an image.
4. Explain sampling and quantization for digitizing images. How is a digital image represented ?



5. Write steps for Filtering in the Frequency Domain. Write down the significance of Fourier Transform in image processing.
6. What do you understand by region splitting and merging segmentation scheme ? Explain region splitting and merging algorithm steps in brief.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What do you mean by an image histogram ?
- b) Critically comment about the quality of the images with respect to following :
 - i) Histogram clustered at the low end
 - ii) Histogram clustered at the high end
 - iii) Histogram with a small spread
 - iv) Histogram with a wide spread.
- c) An image is represented by the following table

Graylevels	0	1	2	3	4	5	6	7
No. of pixels	1116	4513	5420	2149	1389	917	654	226

Find an image from this image after histogram equalization.

It is desired to transform this image into a new image, using



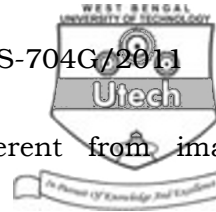
a transformation $z = H(r) = G^{-1} [T(r)]$, with histogram as specified below :

k	z_k	$pout(z_k)$
0	0	0.00
1	1/7	0.00
2	2/7	0.00
3	3/7	0.15
4	4/7	0.20
5	5/7	0.30
6	6/7	0.20
7	1	0.15

2 + 4 + 9

8. a) Write the expression for
- 2D DFT and its inverse
 - Fourier Spectrum
 - Phase angle and Power Spectrum
- b) Why is high pass filtering used to enhance an image ?
Explain ideal filter and butterworth filter.
- c) How many minutes are required for a 512×512 image with 256 grey levels at 300 baud rate for transmission?
The transmission is accomplished using packets consisting of a start bit, a byte (8 bits) of information and a stop bit. Baud rate means number of bits per second.

$$(2 \times 3 + (2 + 2 + 2) + 3)$$



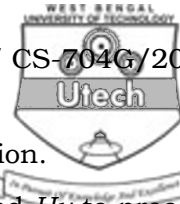
9. a) Why is image enhancement different from image restoration ?
- b) Explain the Median filter technique with an example. Write down the advantages and disadvantages of Median filter over the Mean/Average filter technique
- c) Explain the action of the following spatial mask on an image.

0	-1	0
-1	4	-1
0	-1	0

- d) How does the "salt and pepper" noise look like ? How can it be removed ? $3 + 3 + 2 + 3 + 2 + 2$
10. a) What is an edge ? Explain with an example.
- b) Discuss the role of the Laplacian operator as an edge detector. What is the major shortcoming of the Laplacian operator ?
- c) How can you detect a line oriented around 45° ?
- d) What do you mean by zero crossing in edge detection ?
- e) Find the results of applying Robert's edge operator to the following image matrix. For the result, you can neglect top row and left column.

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

$$2 + 3 + 2 + 1 + 2 + 5$$



11. a) Discuss Hough transform for line detection.
 - b) A Sobel operator uses two masks, H_x and H_y to process the image for edge detection. Explain what is measured by these masks and why two masks are required.
 - c) "Quad-tree representation of image with large homogeneous regions is less expensive." Why ?
 - d) Consider a grayscale I image whose grayscale values $I(r, c)$ of r^{th} row and c^{th} column is lying between 0 and 255. For the range of all gray level values from 30 to 75, we want to stretch the range from 45 to 255. Obtain the equation for such type of stretching.
 - e) For what purpose smoothing filters are used in image enhancement phase ? $5 + 3 + 2 + 3 + 2$
12. Write short notes on any three of the following : 3×5
 - a) Image acquisition
 - b) Special filters
 - c) GIS as an information system
 - d) Homomorphic filtering
 - e) Otsu method

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