

VI SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING)

## END SEMESTER EXAMINATIONS, APRIL/MAY 2017

## SUBJECT: ELECTIVE III DIGITAL IMAGE PROCESSING [CSE 4003]

## REVISED CREDIT SYSTEM (29/04/2017)

Time: 3 Hours

MAX. MARKS: 50

4M

## Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.
- **1A** Explain the fundamental steps in Digital Image Processing.
- 1B. Define 4 adjacency and m adjacency. Consider the two image subsets, S<sub>1</sub> and S<sub>2</sub> shown in the Fig.Q1B. For V= {1}, determine whether these two subsets are (i) 4-adjacent, (ii) m-adjacent. Justify your answer.

 $S_1$  $S_2$ 0 0 0 1 0 0 1  $1 \, i \, 0$ 0 0 1 0 0 1 0 0 1 0 0 1 3M 1 • 0 1 1 1 0 L 0 0 0 0 0 0 0 1 1 1 0 0 1 1 1 0 0 1 1 0 0 1 Fig. Q 1B

- 1C Give the expressions for finding the 1D first order and second order derivatives. Consider the following sequence that shows intensity values for a single scan line. Calculate the responses of 1D first order and second order derivatives and analyze their behavior.
   6 6 6 5 4 3 2 1 1 1 1 1 6 6 6 6 6
- 2A. How can you use illumination-reflectance model to develop a frequency domain procedure for improving the appearance of an image?4M
- **2B.** An image with intensities in the range [0,1] has the PDF  $p_r(r)$  shown in Fig. Q. 2B. It is desired to transform the intensity levels of this image so that they will have the specified  $p_z(z)$  shown. Assume continuous quantities and find the transformation (in terms of r and z) that will accomplish this.



- 2C. Show that convolution of an image with a filter in spatial domain is equivalent to product of Fourier Transform of the image and transfer function of the filter 3M in frequency domain.
- **3A.** Write the adaptive median filtering algorithm for image restoration and **4M** explain the same
- **3B.** Prove the validity of the following equations. (F()]represents Fourier transform and  $F^*()$  represents the complex conjugate of F())

(i) 
$$f(x,y)e^{j2\pi(u_0x+v_0y)} = F(u-u_0,v-v_0).$$
 3M  
 $F^*(-u-v) = -F(u,v).$ 

(ii) If f(x,y) is imaginary,

3C. Write the algorithm for finding a polygonal fit to open and closed curves 3M
4A. Derive an expression for between class variance of an image and hence show how it can be used to obtain the optimal threshold for segmentation. 5M Consider PDFs of object and background as Gaussian.

- **4B.** Explain the region growing, region splitting and merging techniques for image segmentation. **3M**
- **4C.** Explain the following ways to estimate the degradation function for image restoration
  - (i) Estimation by Image Observation 2M
  - (ii) Estimation by Experimentation
- **5A.** Give the expressions for the following operations for gray scale images
  - (i) erosion and dilation using flat structuring element
  - (ii) erosion and dilation using non flat structuring element
  - (iii) opening and closing operations

and explain the properties that opening and closing operations for gray scale images, have to satisfy

- 5B. Explain the following Morphological Algorithms1M(i) Hole Filling2M(ii) Extraction of Connected Components1M(iii) Boundary Detection1M
- 5C. Explain the following noise reduction filters and also indicate what type of noise is removed by each of these filters.
   (i) Harmonic Mean Filter
  - (i) Harmonic Mean Filter
  - (ii) Max and Min Filter

**4M**