Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ECE)/SEP.SUPPLE/SEM-8/EC-803D/2012

2012

DIGITAL 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) An image is a 2D array of

   a) digital data b) electrical signals

   c) photographic objects d) light signals.

   ii) A line sensor is used to

   a) capture a scene b) capture a 3D image

   c) scan a 2D image d) none of these.

   iii) What device is used to form an image on the film of a camera ?

   a) A *p-n-p* transistor b) A converging lens

   c) An Op-Amp d) A plane mirror.

iv) If an input image is $f(x, y)$ and a transform T is operated to get an processed image $g(x, y)$ we can write

a) $f(x,y) = T[g(x,y)]$ b) $f(x,y) = T / g(x,y)$

c) $g(x,y) = T[f(x,y)]$ d) none of these.

v) If a function $f(x, y)$ is real, and we have $F(u,v) = 2DFFT[f(x,y)]$,

a) $F(u,v)$ contains only real parts

b) $F(u,v)$ contains only imaginary parts

c) $F(u,v)$ contains both real and imaginary parts

d) none of these.

vi) Edge detection of an image broadly means

a) low spatial frequency enhancement

b) high spatial frequency enhancement

c) thresholding low spatial frequencies

d) none of these.

vii) If a function $f(x, y)$ is finite in the space domain, the Fourier transform of $f(x, y)$ will be

a) finite b) infinite

c) undefined d) zero.

viii) The classical Hough transform is concerned with the identification of

a) lines in an image b) zeros in an image

c) poles in an image d) none of these.

ix) A wavelet transform is a special case of

a) Laplace transform b) Z-transform

c) Fourier transform d) none of these.

x) If we have an image in EPS and JPEG format

a) the JPEG file will be larger in size

b) the EPS file will be larger in size

c) both files will be equal in size

d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) Write down the name of an image capturing technique/device.
   b) Briefly explain the working principle of the image capture by that technique/device.
   c) How can the captured images be transferred to a PC ? 1 + 3 + 1

3. a) What do you mean by image enhancement ?
   b) Write about a transform or operation that can be used for image enhancement. Explain. 2 + 3

4. a) How do you represent a gray scale image ?
   b) How do you represent a colour image ? 2 + 3

5. Write short notes on any *two* of the following : 2 × 2½
   a) Skeletonization of images
   b) Thinning of images
   c) Fourier descriptors.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

6. a) You are given a transformable image $g(x, y)$. Write down the expression for its continuous Fourier transform considering (u, v) the spatial frequency coordinate corresponding to the space coordinates (x, y). What is the unit for spatial frequency ?
   b) Write down the expression for the N point discrete Fourier transform.
   c) Write down the expression for N point Fast Fourier transform and explain how it is faster than the discrete Fourier transform algorithm. 3 + 2 + 10

7. a) What do you mean by smoothing and sharpening of an image ?

   b) Somebody has captured a photograph as shown in figure below.

      i) If we want to remove the horizontal lines and get a clear image of the letter 'D', what we have to do ?

      ii) Can you get an image of the lines and remove the letter 'D' ? Explain your answers with flow diagrams wherever appropriate.

(2½ + 2½) + 5 + 5

8. a) What is meant by image segmentation ?

   b) What is meant by image compression ?

   c) Name a transform that can be used for image compression and explain how it can be used for image compression. 2½ + 2½ + 10

9. a) What do you mean by image recognition ?

   b) What is meant by classification of image ?

   c) Describe any image recognition technique. How is it used for image classification ? 2 + 3 + 10

==========