M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.
Second Semester
Applied Electronics
DS 7201 — ADVANCED DIGITAL IMAGE PROCESSING
(Regulations 2013)

Time: Three hours  Maximum: 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define brightness adaptation.
2. What is mach band effect?
3. How do you recognize that an image is getting over segmented?
4. What are the various methods of thresholding in image segmentation?
5. List the drawbacks of the laplacian operator based edge detection method.
6. What is the use of fractals in feature extraction?
7. Mention the steps involved in image registration procedure.
8. Point out the potential advantages of image fusion.
9. Name the various sources for 3D dataset creation.
10. What is ray tracing? What is its use?

PART B — (5 × 13 = 65 marks)

11. (a) Explain about image enhancement in spatial and frequency domain methods.

Or

(b) Find a singular value decomposition of a matrix \( A = \begin{bmatrix} 1 & -2 & 3 \\ 3 & 2 & 1 \end{bmatrix} \).
12. (a) Explain in detail about segmentation by morphological watersheds.

Or

(b) Consider the $8 \times 8$ image segment given by

$$I = \begin{bmatrix} I_1 & I_2 \\ I_3 & I_1 \end{bmatrix}$$

where

$$I_1 = \begin{bmatrix} 128 & 128 & 128 & 64 \\ 64 & 64 & 128 & 128 \\ 32 & 8 & 64 & 128 \\ 8 & 128 & 128 & 64 \end{bmatrix}, \quad I_2 = \begin{bmatrix} 64 & 32 & 32 & 8 \\ 128 & 8 & 32 & 32 \\ 128 & 64 & 64 & 64 \\ 64 & 8 & 64 & 64 \end{bmatrix},$$

$$I_3 = \begin{bmatrix} 128 & 64 & 64 & 64 \\ 64 & 64 & 64 & 128 \\ 8 & 128 & 32 & 64 \\ 8 & 8 & 64 & 64 \end{bmatrix}.$$

Using the histogram information segment the image into two regions.

13. (a) Explain in detail about texture analysis using gray level co-occurrence method and autocorrelation function method with suitable examples.

Or

(b) (i) Briefly explain about shape skeletonization and boundary extraction methods. (7)

(ii) Explain how Hough transform works in the feature extraction of image shapes. (6)

14. (a) (i) Explain the steps to be involved in image registration process. (6)

(ii) Explain the methods for determining a transformation function to map a sensed images to reference image. (7)

Or

(b) Discuss in detail about image resampling using nearest neighbor and cubic spline interpolation methods.

15. (a) Explain with neat diagrams volumetric display of 3D image visualization.

Or

(b) Write short notes on the following:

(i) Image processing in 3D (6)

(ii) Measurements on 3D images. (7)

PART C — (1 x 15 = 15 marks)

16. (a) Compute the basis of the KL transform for the following input data:

$$X_1 = (4, 4, 5)^T, \quad X_2 = (3, 2, 5)^T, \quad X_3 = (5, 7, 6)^T, \quad X_4 = (6, 7, 7)^T.$$

Or

(b) Explain in detail, Gabor filter and wavelet features for the classification of images.