

# SIXTH SEMESTER B.TECH DEGREE EXAMINATION

## 13.601 IMAGE PROCESSING (AT)

Time: 3 Hours

Max. Marks : 100

### PART - A

(Answer all questions. Each question carries 4 marks. )

1. Determine whether the system described by the following input output relation is linear, shift invariant  $y[n_1, n_2] = e^{x[n_1, n_2]}$
2. Describe how homomorphic filtering is used to separate illumination and reflectance components?
3. Differentiate between region growing segmentation and threshold based segmentation.
4. Why Laplacian operator is normally used for image sharpening operation?
5. Explain with example different areas of applications of image processing

### PART - B

(Answer any one question from each Module. )

#### Module - I

6. (a) Perform linear convolution between two 2D sequences  $X[m, n] = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$  and  $h[m, n] = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$   
(10 marks)

(b) Prove linearity and time shifting properties of 2D Fourier transform.  
(5 marks)

(c) Write short note on image sensors.  
(5 marks)

7. (a) Compute 2D DFT of the following image segment  $X$  using 1D DFTs  $X = \begin{bmatrix} 2 & 4 \\ 3 & 8 \end{bmatrix}$   
(10 marks)

(b) With block diagram explain different steps involved in digital image processing  
(10 Marks)

#### Module - II

8. (a) What is a histogram? Explain why the discrete histogram equalization technique does not in general yield a flat histogram.  
(5 marks)

- (b) Analyze a 3x 3 mean filter in the frequency domain and prove that it behaves like a low pass filter. (10marks)  
(c) Generate 3x3 Gaussian mask with appropriate variance . ( 5 marks)

9. (a) Derive the expression for the transfer function of a 2D Wiener filter (10 marks).  
(b) What is a median filter? What are its features? (5 marks)  
(c) What is ringing? Why ideal low pass and high pass filters lead to ringing effects? (5marks)

### Module - III

10. (a) what is gray level co-occurrence matrix. Explain its application in image analysis (10 marks)  
(b) Explain the steps in obtaining the edges using Canny Edge detector (10 Marks)
- 11 (a) Briefly explain different types of thresholding technique used in image segmentation (10 Marks)  
(b) Generate at least 3 geometrical shapes (other than rectangle and square) and specify the following (i) Chain code 4D and 8D (ii) shape number (5marks)  
(c) Explain boundary descriptors (5 marks)

### Module - IV

11. (a) Explain morphological operations required for generating the skeleton of an image (10 Marks)  
(b) Explain in detail about lossy and lossless compression scheme. (10 marks)
12. (a) Write short notes on (i) Binary morphology (ii) CMY colour model (10 marks)  
(b) What are the different steps in compressing a JPEG image (10 marks)