Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code : 20ECT352

Course Name: Digital Image Processing

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain the terms brightness, hue and saturation with respect to a digital image.
2. List and explain the different types of connectivity among pixels.
3. With suitable examples bring out the structural difference between Circulant and Toeplitz matrices.
4. Construct a Hadamard matrix of order four.
5. List and describe any two point processing operations with necessary graphs.
6. Find out the value of the middle pixel after applying a 3 x 3 median filter.

$$\begin{bmatrix} 1 & 0 & 8 \\ 5 & 4 & 9 \\ 1 & 0 & 0 \end{bmatrix}$$

7. Differentiate between constrained and unconstrained restoration.
8. Explain the image degradation and restoration model.
9. Explain the need for image compression.
10. What are the basic data redundancies exploited in image compression?

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) State and explain 2D sampling theorem. Show that the spectrum of a sampled image is a scaled and shifted repetition of spectrum of original image with constant spacing along x axis and y axis. (8)
    b) With a neat diagram explain the working of a Vidicon camera tube. (6)

OR

12. a) Discuss the conceptual relationship between the RGB and HSI colour models with neat sketches. (7)
    b) Explain the fundamental steps in digital image processing. (7)

MODULE II

13. a) State and prove any two properties of 2D DFT. (8)
    b) Using Haar transform, compute the transform coefficients for the image segment, $I = \begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}$. (6)

OR

14. a) Compute the 2D DFT of matrix, $X=\begin{bmatrix} 4 & 6 \\ 3 & 4 \end{bmatrix}$. (7)
    b) What is Singular value decomposition? Explain how each factor in SVD can be found out? (7)

MODULE III

15. a) With necessary equations, explain how low pass and high pass filtering is done in the frequency domain. (7)
    b) Consider the following image of size 5x5. It has gray level values from 0-7. Perform the histogram equalization of the image and obtain the final image.

5	5	5	5	5
3	5	7	5	3
3	7	7	7	3
3	5	7	5	3
5	5	5	5	5

(7)

OR

16. a) Explain how homomorphic filtering is used in image enhancement. (6)
    b) Distinguish between smoothing and sharpening filters. Give the appropriate mask for a smoothing and sharpening filter. (8)

MODULE IV

17. a) Write a short note on Lagrange multipliers. (6)
    b) With appropriate equations, explain the issue with inverse filtering for restoring the image. How Wiener filtering eliminates the issue? (8)

OR

18. a) Explain the various geometric transformations. (6)
    b) Derive a Wiener filter for image restoration using a minimum mean square approach. Give the condition in which Wiener filter reduces to an inverse filter. (8)

MODULE V

19. a) Explain the region splitting and merging approach for image segmentation. (7)
    b) What is clustering? Explain the commonly used clustering techniques for image segmentation. (7)

OR

20. a) What are the different types of edges present in an image? Explain the two approaches for the detection of edges in an image. (6)

b) Describe the concept of bit plane coding and run length coding used for image compression. (8)

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