Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) Exam April 2025 (2019 Scheme)

Course Code: ECT352

Course Name: DIGITAL IMAGE PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1	Compare the working principles of Vidicon and digital cameras.	(3)
2	Discuss the fundamental principles behind RGB, CMY, and HIS color models.	(3)
3	Discuss the role of run-length encoding in lossless image compression and how it contributes to reducing data size.	(3)
4	Explain the concept of transform coding in image compression. How does it contribute to reducing redundancy in image data?	(3)
5	Describe the process of image subtraction in the spatial domain. How can this technique be applied to specific applications in image enhancement?	(3)
6	Discuss the purpose of sharpening filters in spatial domain methods. Explain the operation of a sharpening filter and its impact on image details.	(3)
7	Describe the various forms of image blurring.	(3)
8	Differentiate between *constrained and unconstrained* image restorations.	(3)
9	Contrast the Sobel and Prewitt operators in terms of their effectiveness in edge detection.	(3)
10	How are the edges in an image categorized?	(3)

PART B

Answer one full question from each module, each carries 14 marks.

Module I

11	a)	Define and discuss the concepts of brightness, contrast, hue, and saturation in the context of digital image processing.	(8)
	b)	Elaborate on the importance of 2D sampling in digital image processing and discuss the process of quantization.	(6)

OR

12	a)	Define image representation and explain the basic relationship between pixels in digital images.	(7)

b) Describe the Mach Band Effect and its significance in the perception of edges in images. Provide examples to illustrate. (7)

Module II

13 a) Consider the matrix $x = \begin{bmatrix} 201 & 124 \\ 345 & 267 \end{bmatrix}$. Calculate the 2D Discrete Fourier Transform (DFT) of the given matrix. (6)

b) Explain bit-plane coding and evaluate the efficiency of bit-plane coding in terms of compression ratio and computational complexity. Compare its performance with other lossless compression methods. (8)

OR

14 a) Compute the 8-point Discrete Cosine Transform (DCT) for the given data set $Y = \{1,3,5,7,9,11,13,15\}$. (6)

b) Provide real-world examples where predictive coding is employed in image compression. Discuss scenarios where predictive coding is particularly effective and its limitations. (8)

Module III

15 a) Explain the concept of intensity transformations in point processing for image enhancement. Provide examples of applications and discuss the impact of these transformations on image quality. (7)

b) Explore the concept of sharpening filters in spatial filtering for image enhancement. Discuss the trade-offs involved in sharpening and provide examples of scenarios where sharpening filters are beneficial. (7)

OR

16 a) Explain the concept of image averaging in spatial domain methods. Discuss its role in reducing noise and enhancing image quality. Provide examples and discuss the limitations of image averaging. (7)

b) Discuss the principles of high-pass filtering in frequency domain methods. Provide real-world examples of applications and discuss the impact of high-pass filtering on image enhancement and feature extraction. (7)

Module IV

17 a) Explain the concept of a degradation model in image restoration. Discuss how it represents the relationship between the original and degraded images. (7)

b) Discuss the Wiener filtering technique in image restoration. Explain how it considers both the characteristics of the image and the noise to enhance the (7)

restoration process.

OR

18 a) Differentiate between unconstrained restoration and constraint restoration in image processing. Provide examples of algorithms falling under each category. (7)

b) Explore spatial transformations as a subset of geometric transformations in image processing. Provide examples and discuss their applications in image restoration. (7)

Module V

19 a) Classify image segmentation techniques into two main categories and provide brief explanations for each category. (7)

b) Define and discuss the concept of segmentation based on thresholding. Highlight scenarios where thresholding is an effective segmentation technique. (7)

OR

20 a) Explain the principles behind edge-based segmentation. Discuss how identifying edges can contribute to image segmentation. (7)

b) Explain the Hough transform and its application in image analysis, particularly in the context of detecting lines. Provide a step-by-step description of how the Hough transform works. (7)

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