Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S,FE) Examination December 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	Why are pixels fundamental in the representation of digital images, and how do they contribute to the basic structure of an image?	(3)
2	Explain the Mach Band effect and its significance in visual perception.	(3)
3	Discuss any three properties of the Discrete Fourier Transform and its importance in image processing.	(3)
4	Explain the concept of transform coding in image compression. How does it contribute to reducing redundancy in image data?	(3)
5	Explain the concept of intensity transformations in the context of image enhancement.	(3)
6	Elaborate on the concept of image averaging for spatial domain enhancement	(3)
7	In which condition does the Wiener filter transform into an inverse filter? Explain	(3)
8	Mention three factors that can lead to the deterioration of image quality.	(3)
9	Contrast the Canny edge detection method with the Laplacian of Gaussian edge detection technique.	(3)
10	How is the concept of image clustering different from image classification- Clarify	(3)

PART B

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

Module I

11	a)	Outline the elements of visual perception and present a simple image formation model.	(7)
	b)	Elaborate on the importance of 2D sampling in digital image processing and discuss the process of quantization.	(7)

OR

12 a) Compare and contrast the working principles of a Vidicon camera and a Digital camera. (7)

b) Explain the fundamentals of colour images, focusing on the RGB, CMY, and HIS colour models. (7)

Module II

13 a) Provide a detailed overview of three basic lossless compression techniques: bit plane coding, run-length encoding, and predictive coding. Illustrate with examples. (8)

b) Construct a Walsh-Hadamard Transform Matrix for an order of 4. Write down the elements of the matrix in their respective rows and columns. (6)

OR

14 a) Explain how the JPEG image compression standard utilizes transform coding. Discuss the key components and processes involved in the JPEG compression algorithm. (8)

b) Consider the matrix $y = \begin{bmatrix} 125 & 237 \\ 342 & 189 \end{bmatrix}$. Calculate the 2D Discrete Fourier Transform of the given matrix. Present the detailed steps of the computation and display the resulting DFT. Matrix method can also be used. (6)

Module III

15 a) Analyse the application of image subtraction in spatial domain methods for image enhancement. Discuss scenarios where image subtraction is useful and elaborate on its impact on the final image. (6)

b) Explore the concept of homomorphic filtering in the frequency domain. Discuss its applications in image enhancement, especially in scenarios with varying illumination conditions. With an example, discuss the advantages of homomorphic filters. (8)

OR

16 a) Describe the significance of histogram processing in image enhancement. Discuss how histogram equalization improves image contrast and detail. Provide real-world examples to illustrate its effectiveness. (7)

b) Explain the role of low-pass filtering in frequency-domain methods for image enhancement. Discuss how it affects image characteristics and provide examples of when low-pass filtering is preferred. (7)

Module IV

17 a) Describe the role of the Lagrange multiplier in unconstrained image restoration. Discuss how it helps balance the trade-off between fidelity to the data and smoothness of the restored image. (7)

b) Elaborate on techniques for removing complex motion blur in images. Discuss challenges and considerations in handling non-uniform motion blur. (7)

OR

18 a) Explain the concept of inverse filtering and how it can be employed to remove blur caused by uniform linear motion in images. (7)

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

Module V

19 a) Explain the region-based approach to image segmentation by providing the example of an algorithm that falls under this category. (6)

b) Compare the different edge detection techniques. Discuss the strengths and weaknesses of popular methods such as Sobel, Prewitt, and Canny. (8)

OR

20 a) Discuss the concept of segmentation based on thresholding. Highlight a scenario where thresholding is an effective segmentation technique. (7)

b) Introduce active contour models in image segmentation. Discuss the principles of active contours and their advantages in handling complex image boundaries. (7)

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