Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) Examinations April 2026 (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		Define image resolution and explain how it differs from pixel intensity.	(3)
2		What causes false contouring in an image?	(3)
3		Compute the 2D Haar transform of the signal $f(m,n) = \begin{bmatrix} 4 & -1 \\ 2 & 3 \end{bmatrix}$	(3)
4		Illustrate the Separable and Spatial shift properties of DFT	(3)
5		What is the role of derivative filters in image enhancement?	(3)
6		State any two applications of image subtraction in practical image enhancement tasks.	(3)
7		Write the mathematical expression representing the degradation model in image restoration.	(3)
8		What is the purpose of applying translation in an image? Write its transformation matrix.	(3)
9		List the two main image segmentation approaches and mention one example for each.	(3)
10		Explain the difference between global and adaptive thresholding.	(3)

PART B

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

Module I

11	a)	Explain in detail the elements of a digital image processing system with neat diagram	(7)
	b)	Illustrate the basic relationships between pixels – adjacency, connectivity, regions, and boundaries	(7)

OR

12	a)	Explain the image formation model considering illumination and reflectance components.	(7)

b) Discuss RGB, CMY, and HSI colour models and show how to convert RGB to HSI using equations. (7)

Module II

13 a) Explain the steps involved in transform coding and discuss its advantages in image compression. (6)

b) Derive the 2D Discrete Walsh Transform for a 4×4 image matrix. (8)

OR

14 Obtain the KL Transform for the given matrix $X = \begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix}$ (14)

Module III

15 a) Explain smoothing spatial filters and their role in noise reduction. (7)

b) Given an image $f(m,n) = \begin{bmatrix} 128 & 212 & 225 \\ 54 & 62 & 124 \\ 140 & 152 & 156 \end{bmatrix}$. Determine the output image g(m,n) using log transformation $g(m,m) = [c\ log_{10}(1 + f(m,n))]$ by choosing i) $c = 1$ $ii)$ $c = \frac{255}{log_{10}(1+255)}$ (7)

OR

16 a) Explain homomorphic filtering and how it helps in illumination correction. (6)

b) Filter the following image using a 3 x 3 neighbourhood averaging by assuming (a) zero padding, and (b) pixel replication. (8)

$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 4 & 2 & 5 & 1 \\ 1 & 2 & 6 & 3 \\ 2 & 6 & 4 & 7 \end{bmatrix}$$

Module IV

17 a) Explain rotation, scaling, and shearing transformations with matrix equations. (9)

b) Differentiate between inverse filtering and Wiener filtering in image restoration. (5)

OR

18 a) Derive the expression for the Wiener filter in terms of the power spectral densities of signal and noise. (8)

b) Differentiate between noise and blur in image restoration. (6)

Module V

19 a) Explain region growing based segmentation and discuss the criteria used for region merging. (8)

b) Explain Laplacian of Gaussian (LoG) method for edge detection. (6)

OR

20 a) Describe edge detection using gradient and Laplacian operators. Derive the mathematical expressions. (7)

b) Explain the Hough Transform technique for detecting lines in an image. (7)

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