

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: EC370

Course Name: Digital Image Processing

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks

Marks

- 1 a) a) An image $f(x, y) = 2 \cos 2\pi (3x + 4y)$ is sampled with sampling intervals $\Delta x = 0.2$ and $\Delta y = 0.2$ in x and y direction respectively. Determine the (7)
- i) Sampled image spectrum
 - ii) Fourier transform of image after it has been low pass filtered
 - iii) Reconstructed image.
 - iv) Will the system produce aliasing error?
- b) For the image segment $I = \begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}$, compute the transform coefficients using (8)
- i) DFT
 - ii) Haar transform
- 2 a) State and explain 2D sampling theorem for band limited images. (8)
- b) What are orthogonal transforms? Define the energy compaction property of an unitary transform. (7)
- 3 a) State and prove any two properties of 2D DFT. (6)
- b) Explain how colour images are represented using HSI colour space model. (9)

PART B

Answer any two full questions, each carries 15 marks

- 4 a) Give a short note on geometric transformations. (7)
- b) Write the algorithm for computing median of an $n \times n$ neighbourhood. (8)
- What is the value of middle pixel after applying a i) 3×3 median filter and ii) 3×3 box filter ?
- $$\begin{bmatrix} 1 & 0 & 8 \\ 4 & 4 & 9 \\ 1 & 0 & 0 \end{bmatrix}$$
- 5 a) Derive the transfer function of Wiener filter. Give the condition in which Wiener filter reduces to an inverse filter. (10)
- b) Distinguish between unsharp masking and high boost filtering. (5)

- 6 a) A 4 x 4 image patch (4 bits/pixel) is given by $I = \begin{bmatrix} 12 & 9 & 12 & 10 \\ 12 & 14 & 8 & 10 \\ 9 & 13 & 12 & 10 \\ 12 & 14 & 12 & 10 \end{bmatrix}$ (8)

Apply histogram equalization to the image by rounding the resulting image pixels to integers. Sketch the histograms of original image and histogram equalised image.

- b) Explain constrained and unconstrained image restoration. (7)

PART C

Answer any two full questions, each carries 20 marks

- 7 a) Obtain the Huffman code for the word 'IMAGEPROCESSING' and determine its efficiency. (10)
- b) Explain how Hough transform can be used to detect lines. (10)
- 8 a) Discuss the role of derivatives in edge detection. (10)
- b) State and explain the state of redundancies in images. (10)
- 9 a) Explain split and merge procedure in image segmentation. (10)
- b) With the help of a block diagram, explain DCT based JPEG compression standard. (10)
