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 2π (3x + 4y) is sampled with sampling intervals Δx = 0.2 and Δy = 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 x n neighbourhood. (8)

What is the value of middle pixel after applying a i) 3 x 3 median filter and ii) 3 x 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)

****