Reg No.:_____ Name:_____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth semester B.Tech degree examinations (S), September 2020

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) Explain the term "m-connectivity" with respect to a digital image. (2)

b) Obtain the correlation of the following two matrices using matrix method. (5)

$x(m,n) = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $h(m,n) = \begin{bmatrix} 3 & 4 \\ 4 & 4 \end{bmatrix}$

c) Compare 2D DFT and DCT of the gray scale image, (8)

$$f(m,n) = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$$

2 a) Explain the principle of sampling and quantization. Discuss its effect on increasing (i) sampling frequency and (ii) quantization levels of image. (8)

b) With diagram, explain the different colour image models. (7)

3 a) Obtain KL transform basis for the following matrix (8)

$$X = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

b) State and prove convolution property and periodicity property of 2D DFT. (7)

PART B

Answer any two full questions, each carries 15 marks

4 a) Derive a Wiener filter for image restoration using minimum mean square approach. Give the condition in which Wiener filter reduces to an inverse filter. (10)

b) Perform histogram equalization of an image shown below: (5)

$$f(m,n) = \begin{bmatrix} 3 & 2 & 4 & 5 \\ 7 & 7 & 8 & 2 \\ 3 & 1 & 2 & 3 \\ 5 & 4 & 6 & 7 \end{bmatrix}$$

5 a) Explain the image restoration model. (5)

b) Explain the different spatial filtering techniques used in images. Distinguish them with appropriate masks. (7)

c) Give the drawbacks of inverse filtering in image restoration. (3)

6 a) Write a short note on Lagrange multipliers. (4)

b) Define homomorphic filtering with necessary equations. (4)

c) What is median filtering? Calculate the median value of underlined pixels given below using a 3×3 mask. (7)

$$f(m,n) = \begin{bmatrix} 12 & 13 & 22 & 26 & 32 & 24 \\ 34 & \underline{123} & \underline{24} & \underline{100} & \underline{34} & 22 \\ 14 & 15 & 13 & 32 & 31 & 21 \end{bmatrix}$$

PART C

Answer any two full questions, each carries 20 marks

7 a) Explain the region based approaches to image processing. (10)

b) Explain any DCT based image compression scheme. Compare the same with Wavelet based image compression method. (10)

8 a) An information source produces sequences of independent symbols *A,B,C,D,E,F,G* with corresponding probability1/3, 1/27, 1/3, 1/9, 1/9, 1/27 & 1/27. Construct a binary code using Huffman coding algorithm. (5)

b) Explain how the wavelet transform can be used for image compression. (5)

c) Construct arithmetic coding to encode and decode the word "INDIA". (10)

9 a) Explain the methods of thresholding for image segmentation. (6)

b) Explain edge detection using gradient operator. Explain edge linking using Hough transform. (10)

c) Segment the data sets (4,6), (5,10), (8,9), (3,9), (2,8), (8,4), (5,1) and (4,2) into two clusters based on K means algorithm with initial sets as (3, 9) and (8, 4). (4)

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