Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree (S, FE) Examination January 2023 (2015 Scheme)

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) What are the components of a general purpose digital image processing system? Explain with the help of a block diagram.   (5)

   b) What is unitary transform? Write the properties of unitary transforms. Prove that 4 x 4 DFT matrix is unitary.   (6)

   c) Define DCT. What are the advantages of Discrete Cosine Transform in image processing?   (4)

2 a) Compute the Haar transform of the image segment represented as $A = \begin{bmatrix} 100 & 50 \\ 60 & 40 \end{bmatrix}$ (5)

   b) Explain (i) False contouring, and (ii) Mach band effect.   (7)

   c) Discuss the concept of "m-connectivity" among pixels in a digital image.   (3)

3 a) Compute the 2D DFT of the following 4 × 4 grayscale image.   (7)

$$f[x, y] = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$$

   b) What is colour space? Explain the RGB and CMY colour spaces with relationship between them.   (8)

PART B

Answer any two full questions, each carries 15 marks

4 a) Perform the histogram equalization of the following image of size 6x6 and obtain the final image.   (10)

0	0	0	1	1	1
2	2	3	2	2	7
3	0	7	4	7	5
3	4	4	2	4	5
2	7	6	7	7	5
6	5	3	6	6	0

   b) Write short notes on lagrange multiplier.   (5)

5 a) Give the mathematical analysis and procedure to implement homomorphic filter approach. (5)

b) What is the difference between image restoration and image enhancement.? Give an example for each. (5)

c) With the help of a block diagram, explain the image degradation model. (5)

6 a) What is median filter in digital image processing? (5)
Justify the statement that "Median filter is an effective tool to minimize salt-and-pepper noise" by filtering the image matrix given below by a 3x3 mask.

$$\begin{bmatrix} 24 & 22 & 33 & 25 & 32 & 24 \\ 34 & 255 & 24 & 0 & 26 & 23 \\ 23 & 21 & 32 & 31 & 28 & 26 \end{bmatrix}$$

b) Derive the transfer function of Wiener filter and state its advantages over inverse filter. What is its drawback? (10)

PART C

Answer any two full questions, each carries 20 marks

7 a) Describe region growing and region splitting & merging approach of image segmentation. (10)

b) What is transform based compression? Draw the block diagram and explain. (7)

c) What is Laplacian of an image? Give an appropriate mask for Laplacian operator. (3)

8 a) Construct the Huffman code for the image segment given below. Also find its efficiency. (10)

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

b) Distinguish between local and global thresholding techniques for image segmentation. (5)

c) Draw the block diagram of a wavelet based image coding systen and explain. (5)

9 a) With a block diagram, explain the JPEG compression standard. (10)

b) Give the linear filter masks for detecting horizontal, vertical and diagonal edges. (5)

c) How to detect isolated points in an image? (5)

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