Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

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) State and explain the 2D sampling theorem. Explain how aliasing errors can be eliminated? (7)

b) Define the terms brightness, contrast, hue and saturation with respect to a digital image. (4)

c) Explain the terms False contouring and Mach band effect. (4)

2 a) Perform KL transform on the following matrix. (8)

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

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

3 a) Compute the 2D DFT of matrix $x = \begin{bmatrix} 4 & 6 \\ 3 & 4 \end{bmatrix}$ (7)

b) Find the DCT of the sequence x(n) = {11,22,33,44}. (4)

c) Explain the energy compaction property of DCT. (4)

PART B

Answer any two full questions, each carries 15 marks.

4 a) What is meant by histogram equalization of an image? Explain how histogram equalization can be performed on a given gray scale image, with necessary mathematical details. (7)

b) Distinguish between image enhancement and image restoration. Give an example for each. (4)

c) What are the steps involved in homomorphic filtering? (4)

5 a) Distinguish between smoothing and sharpening filters. Give the appropriate masks for any one smoothing and sharpening filters. (8)

	b)	Explain the image restoration mechanism using a Weiner filter.	(7)
6	a)	Explain how a degraded image can be restored using an inverse filter. Explain its limitations.	(7)
	b)	Explain any two geometric transformations on an image.	(4)
	c)	Explain how low pass filtering can be performed using frequency domain method.	(4)

PART C

Answer any two full questions, each carries 20 marks.

7	a)	Explain the method of global thresholding for image segmentation.	(6)
	b)	What is Laplacian of an image? Derive an appropriate mask for the Laplacian operator. Explain how Laplacian can be used for detecting edges in an image.	(9)
	c)	What is a LoG filter? Give an appropriate mask for a LoG filter.	(5)
8	a)	Explain the active contour algorithm for image segmentation.	(8)
	b)	Explain hoe lines can be detected using Hough transform.	(7)
	c)	Compare the image compression standards JPEG and MPEG.	(5)
9	a)	Explain the different steps in dictionary based compression algorithm.	(7)
	b)	Explain the use of wavelet transforms in image compression.	(7)
	c)	Illustrate Huffman coding with an example.	(6)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 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) With a neat diagram explain the working of a Vidicon camera tube. (6)

b) Explain the terms (i) Mach-band effect, (ii) Saturation (iii) 8 - adjacency (6)

c) List the properties of distance functions. (3)

2 a) Write the recursive definition of a Hadamard Transform. Using this definition construct a 4 x 4 Hadamard matrix. (4)

b) Bring out the structural difference between circulant and Toeplitz matrices. Write an example for each. (4)

c) What is Singular value decomposition? Explain how each factor in SVD can be found out? (7)

3 a) State and prove the 2-D Sampling theorem. (6)

b) Write the Forward and inverse transformation kernels for 2D-DFT. Are these kernels separable? Justify your answer. (5)

c) Suppose the eigen vectors of covariance matrix of the 2-dimensional data are $e_1 = \begin{pmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \end{pmatrix}$ and $e_2 = \begin{pmatrix} 1/\sqrt{2} \\ -1/\sqrt{2} \end{pmatrix}$ respectively. If the mean vector of data is zero, find the KL transform of the data point $x = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$ (4)

PART B

Answer any two full questions, each carries 15 marks

4 a) List and describe any two point processing operations with necessary graphs. (5)

b) Consider the following image of size 5x5. It has gray level values from 0-7. Perform the histogram equalization of the image and obtain the final image. (10)

5	5	5	5	5
3	5	7	5	3
3	7	7	7	3
3	5	7	5	3
5	5	5	5	5

5 a) Differentiate between constrained and unconstrained restoration. (3)

b) Explain the image degradation and restoration model. (4)

c) With appropriate equations, explain the issue with inverse filtering for restoring the image. How Wiener filtering eliminates the issue? (8)

6 a) Explain the smoothing of images in frequency domain using (i) ideal low pass filters and (ii) Butterworth low pass filters. (5)

b) Explain the terms unsharp masking and high-boost filtering. (5)

c) How the separation of illumination and reflectance components is achieved in homomorphic filtering? (5)

PART C

Answer any two full questions, each carries 20 marks

7 a) Explain the Region splitting and merging approach for image segmentation. (6)

b) Differentiate between local, global and adaptive thresholding. (6)

c) How Hough transform is helpful in edge linking? (8)

8 a) What are the basic data redundancies exploited in image compression? Explain. (8)

b) Compare the transforms DCT and KLT as a choice for image compression application. (4)

c) Explain the concept of Arithmetic coding. (8)

9 a) Explain any one clustering algorithm for image segmentation. (8)

b) Perform Huffman coding for the following set of symbols. (8)

Symbol	Probability
A	0.2
B	0.1
C	0.05
D	0.6
E	0.05

c) Name and draw any two types of spatial masks used for edge detection. (4)

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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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