

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. (10)  
 Perform the histogram equalization of the image and obtain the final image.

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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