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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, APRIL/MAY 2018

Branch: Electronics and Communication

Stream(s): Signal Processing

01EC6304 : DIGITAL IMAGE PROCESSING

MAX MARKS: 60

DURATION: 3hrs

Answer any two full questions from each part

Limit answers to the required points.

PART A

- 1.(i) A continuous image  $f(x,y) = 2$ , is ideally sampled at  $\Delta x = \Delta y = 0.25$  and the samples are passed through an ideal LPF with frequency response,  $H(\xi_1, \xi_2) = \begin{cases} \frac{1}{16}, & -4 \leq (\xi_1, \xi_2) \leq 4 \\ 0 & \text{otherwise} \end{cases}$

Find the reconstructed image. (6)

- (ii) Compute the 2D DFT of a 4x4 gray scale image given below. (3)

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

2. (i) Explain the spatial domain filtering in image enhancement. (6)

- (ii) Formulate the Haar Transform matrix for  $N=4$ . (3)

3. i) Compute the K-L Transform of the Image segment  $x(m,n) = \begin{pmatrix} 4 & -2 \\ -1 & 3 \end{pmatrix}$  (5)

- (ii) Perform Histogram equalization on the 3bit image shown below and obtain the histogram equalized image. (4)

$$X(m, n) = \begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$$

**PART B**

4. (i) Explain the process of inverse filtering approach used in image restoration & mention its limitations. (6)  
(ii) What is LOG filter? What is its advantage over Laplacian filter? (3)
5. Explain Wavelet – based JPEG -2000 Image Compression standard. (9)
6. (i) Explain the region based approaches of image segmentation in detail. (5)  
(ii) Explain why we are using transform based compression. (4)

**PART C**

7. (i) Prove the following duality relations in Morphology  
 $(A \oplus B)^C = A^C \ominus B^C$  (ii)  $(A \cdot B)^C = A^C \circ B^C$  (6)  
(ii) Explain dilation and erosion based morphological process. (6)
8. (i) State and prove Fourier- Slice theorem. (6)  
(ii) Explain Hit or miss transformation, thinning & thickening processes in morphological processing. (6)
9. (i) Explain radon transform of a 2\_D function,  $f(x,y)$  (3)  
(ii) Explain digital implementation of Convolution Back-Projection Algorithm for Image Reconstruction. (9)

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