**B**

## APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

**Electronics and Communication Engineering**

**(Signal Processing)**

**01EC6304- Digital Image Processing**

Max.Marks:60                                          Duration: 3 hours

*Answer any two questions from each Section*

### SECTION-I (2X9)

I.

   a. State and explain 2D sampling theorem for band limited images.

   b. An image $f(x,y) = 2cos2\pi(3x + 4y)$ is ideally sampled at a rate $\xi_{xs} = \xi_{ys} = 5$. The reconstruction filter has the frequency response $H(\xi_1, \xi_2) = \begin{cases} 1/25, & -2.5 \leq \xi_1, \xi_2 \leq 2.5 \\ 0 & other\ wise \end{cases}$. Find the reconstructed image.

II.   Find the 2D DFT of an image segment $I = \begin{bmatrix} 4 & 2 & 6 & 10 \\ 6 & 3 & 9 & 15 \\ 8 & 4 & 12 & 20 \\ 6 & 3 & 9 & 15 \end{bmatrix}$ using 1D DFTs.

III.

   a. Compute the Hadamard Transform of an image segment $I = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

   b. Consider an 8 level 64X64 image with normalized gray levels in the range [0, 1]. The normalized histogram is given below. Perform histogram equalization and plot the equalized histogram

| $r_k$ | $n_k$ | $P(r_k)$ |
|-------|-------|----------|
| 0 | 790 | 0.19 |
| $1/7$ | 1023 | 0.25 |
| $2/7$ | 850 | 0.21 |
| $3/7$ | 656 | 0.16 |
| $4/7$ | 329 | 0.08 |
| $5/7$ | 245 | 0.06 |
| $6/7$ | 122 | 0.03 |
| 1 | 81 | 0.02 |

## SECTION-II (2X9)

IV. Derive an expression for the transfer function of a 2D discrete Wiener filter used for image restoration.

V. Explain JPEG still picture compression standard.

VI.

    a. What is a LOG filter? What is its advantage over Laplacian filter?

    b. Explain basic region growing algorithm for image segmentation.

## SECTION- III (2X12)

VII.

    a. Explain the following morphological operations.

| | |
|---|---|
| i. Erosion | iii. Opening |
| ii. Dilation | iv. Closing |

    b. Prove the following relations in morphological operations.

       i. $(A \ominus B)^c = A^c \oplus \hat{B}$

       ii. $(A \oplus B)^c = A^c \ominus \hat{B}$

VIII.

    a. Define Radon transform of a 2D function $f(x, y)$.

    b. Explain Filter Back –projection algorithm for image reconstruction.

IX.

    a. What is hit-and-miss transform? What are its applications?

    b. State and prove Fourier-slice theorem.

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