B.E.-IT. VII (REV)
Digital Signal Image
Processing

Con. 3233-11.　　　　　　　　(REVISED COURSE)　　　　　　　RK-3504

(3 Hours)　　　　　　　　　[Total Marks : 100

N. B. :　(1)　Question No. 1 is **compulsory**.
　　　　(2)　Attempt any **four** questions out of remaining **six** questions.
　　　　(3)　Assume **suitable** data wherever required and **clearly** specify it.

1.　(a)　Give any five classifications of Discrete time systems with examples.
　　(b)　What is an Unitary matrix ? Prove that two dimensional DFT matrix is an Unitary matrix.
　　(c)　Let $x(n) = \{1, 2, 3, 4\}$, Find $X(k)$, FFT using DIT FFT. Using $X(k)$ and not otherwise find FFT of $x_1(n) = \{4, 1, 2, 3\}$.
　　(d)　If $x(n) = \{2, -1, 4, 3\}$ and $h(n) = \{-2, 1\}$. Find linear convolution using circular convolution.

2.　(a)　Differentiate between point operations and neighbourhood operations.　　10
　　(b)　If :—　　　　　　　　　　　　　　　　　　　　　　　　　　　　10

Gray level	0	1	2	3	4	5	6	7
Number of pixels	100	90	85	70	0	0	0	0

Perform histogram stretching so that new image has a dynamic range of [0, 7].

3.　(a)　Find the DFT of the image :—　　　　　　　　　　　　　　10

0	1	2	1
1	2	3	2
2	3	4	3
1	2	3	2

　　(b)　Explain separability property of DFT.　　　　　　　　　　　5
　　(c)　What are blurring and ringing effects ? How can they be avoided ?　　5

4. (a) If $x(n) = \{2, -1, \overset{\uparrow}{3}, 0, 4\}$ obtain following :—   10

        (i) $x(-n)$ (iv) $x(-n + 2)$

        (ii) $x(n - 1)$ (v) $x(2n)$

        (iii) $x(n + 1)$

   (b) For a Discrete time system whose impulse response $h(n) = \{1, \overset{\uparrow}{-2}, 1\}$. Find the   5
output for input $x(n) = \{1, \overset{\uparrow}{2}, 3, 4\}$.

   (c) Classify following DT System on linearity/causality and time variance :—   5
        (i) $y(n) = 2x(n) + x(n - 1)$ (ii) $y(n) = x(2n) + 2$.

5. (a) Using Fast Hadmard transform, find $X(n)$ for $x(n) = \{4, 2, 2, 4\}$.   5
   (b) Calculate the direction of the edge at the center point of the image :   5

$$I = \begin{bmatrix} 50 & 60 & 70 \\ 5 & 50 & 80 \\ 7 & 9 & 50 \end{bmatrix}$$

   (c) Explain the following operations :—   10
        (i) Erosion   (ii) Dilation   (iii) Opening   (iv) Closing

6. (a) Compare Lossless and lossy compression techniques.   5
   (b) Explain Hit-or-Miss transformation.   10
   (c) Explain in detail typical image compression process.   5

7. Write detail notes on any **two** of the following :—   20
        (a) Object detection using correlation principle
        (b) Biometric Authentication
        (c) Digital image processing system
        (d) Content Based image retrieval.