

Con. 6146-11.

(REVISED COURSE)

(3 Hours)

[ Total Marks : 100

N.B.:

1. Question No.1 is compulsory.
2. Attempt any four questions out of remaining six questions.
3. Figures to the right indicate full marks.
4. Answer to the questions should be grouped and written together.
5. Assume any suitable data wherever required but justify the same.

Q.1 Justify/ contradict following statements:

- |    |   |   |
|----|---|---|
| a) | If the energy of the signal is finite its power is zero                   | 5 |
| b) | Laplacian is better than gradient for detection of edges                  | 5 |
| c) | Walsh transform is nothing but sequency ordered Hadamard transform matrix | 5 |
| d) | All Image compression techniques are invertible                           | 5 |

Q.2 a) Find the following sequences are periodic or not. If yes find the fundamental time period. 10

i)  $x_1(n) = e^{j\left(\frac{\pi}{4}\right)n}$  ii)  $x_2(n) = 3 \sin\left(\frac{1}{8}\right)n$

b) Obtain linear convolution of two discrete time signals as below 10

$$x(n) = u(n)$$

$$h(n) = a^n u(n), a < 1$$

$$\text{Show that } y(n) = \frac{1-a^{n+1}}{1-a}$$

Q.3 a) Find cross-correlation between given signals 5  
 $x(n) = \{1, 2, 0, 1\}$

$$y(n) = \{4, 3, 2, 1\}$$

b) Find z-transform of x(n) and draw its ROC 10

$$x(n) = \left[0.5^n \sin\left(\frac{\pi n}{4}\right)\right] u(n)$$

c) Determine auto-correlation of the following signal 5

$$x(n) = \{1, 3, 1, 1\}$$

Q.4 a) Using 4 point FFT algorithm, calculate 2-D DFT of 10

$$f(x,y) = \begin{bmatrix} 0 & 0 & 3 & 1 \\ 1 & 1 & 2 & 2 \\ 2 & 2 & 1 & 3 \\ 1 & 1 & 2 & 4 \end{bmatrix}$$

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Q.4 b) Write 8x8 Hadamard transform matrix and its signal flow graph. Using the Butterfly diagram, compute Hadamard transform for  $x(n) = \{1, 2, 3, 4, 1, 2, 1, 2\}$  10

Q.5 a) Perform histogram equalization and draw new equalized histogram of the following image data 10

Gray Level	0	1	2	3	4	5	6	7
No. of pixels	790	1023	850	656	329	245	122	81

b) What is image segmentation? Explain the following methods of image segmentation. 10

- i) Region growing
- ii) Region splitting
- iii) Thresholding

Q.6 a) What are the different types of redundancies in digital image? Explain in detail. 10

b) For the 3 bit 4x4 size image perform following operations. 10

- i) Thresholding  $T = 4$
- ii) Intensity level slicing with background,  $r_1 = 2$  and  $r_2 = 5$
- iii) Bit plane slicing for MSB and LSB planes
- iv) Negation

4	2	3	0
1	3	5	7
5	3	2	1
2	4	6	7

Q.7 Write notes on (any four) ; 20

- i) Discrete Cosine transform
- ii) Wiener filter
- iii) Difference between Low-pass filter and Median filter
- iv) Hough transform
- v) Homomorphic filter
- vi) 4, 8, m connectivity of image pixels