B.E. (Computer Engineering) Seventh Semester (C.B.S.)

Elective - II : Digital Signal & Image Processing

P. Pages : 3 **NRT/KS/19/3599**

Time : Three Hours * 0 2 8 3 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Define Digital Signal Processing. What are the advantages of DSP over ASP? Also write down some applications of DSP. **7**

b) Consider the analog signal. **7**

$$x_a(t) = -2\sin(300\pi t) + 4\cos(800\pi t) + \frac{7}{2}\sin(1000\pi t)$$

i) What is Nyquist rate of this signal?

ii) If the signal is sampled at the sampling frequency F_s = 2 kHz, what will be the resulting discrete - time sequence?

OR

2. a) Determine whether following discrete time systems are Linear, shift-invariant, causal and stable or not. **8**

i) y(n) = cos{x(n)}.

ii) y(n) = Ax(n-1)+B Where A & B are constants.

b) If u(n) be an unit-step sequence **6**

$$\text{i.e. } u(n) = \begin{cases} 1 & \text{for } x \geq 0 \\ 0 & \text{Otherwise} \end{cases}$$

Sketch the signals

i) $\frac{2}{3}u(n-3)$ ii) - u (n+1)

3. a) Find Z-transform and ROC of the following sequences. **7**

i) x(n) = 3u(n+1) for all n.

ii) x(n) = {------, 3, -1, $\underset{\uparrow}{2}$, 1, 3, ------}

b) Explain any three properties of Z-transform. **6**

OR

4. a) If $X(z) = \dfrac{z}{3z^2 - 4z + 1}$. **7**

Find x (n) for the following ROC's using partial fraction expansion method.

i) ROC : $|z| > 1$

ii) ROC : $|z| < 1$

b) Find pole/zero Plot for the following Z-transform. **6**

$$H(z) = \frac{1 - 3z^{-1} + 2z^{-2}}{1 + 5z^{-1} + 6z^{-2}}$$

5. a) If $y(n) = x(n) * h(n)$, where, '$*$' is an linear convolution operation **7**

prove that $Y\left(e^{jw}\right) = X\left(e^{jw}\right).\ H\left(e^{jw}\right)$

b) Find 4-point DFT of **6**

$$x(n) = \left\{ \underset{\uparrow}{1/2}, 1/4, 1/8, 1/16 \right\}$$

OR

6. a) Find 8-point DFT of **8**

$x(n) = \left\{ \underset{\uparrow}{1}, 0, 0, -3, 1, 0, 0, 2 \right\}$ using

Radix - 2, DIF FFT algorithm.

b) Perform Circular Convolution of **5**

$x_1(n) = \left\{ 2/3, -1, 1/3, 1 \right\}$

$x_2(n) = \{3, 1, 3, 1\}$

7. a) Explain the fundamental steps in digital image processing. **7**

b) Explain the concept of image sampling in detail. What is aliasing? How it can be eliminated? **7**

OR

8. a) Explain sampling and quantization process used for creating digital image. **6**

b) Consider the image segment shown. **8**
Let V = [0,1] and V = [1,2]. Compute length of shortest 4-8 - and m-path between p & q.
Its particular path does not exists between these points explain why.

	3	1	2	1 (q)
	2	2	0	2
	1	2	1	1
(p)	1	0	1	2

9. a) What do you mean by histogram equalization? Discuss with suitable example. **6**

b) Explain the following terms. **7**

i) Log - Transformation

ii) Bit-Plane slicing

OR

10. a) Explain Image Enhancement techniques used for image filtering in spatial domain. **6**

b) Write short note on **any two.** **7**

i) Image subtraction

ii) Image averaging

iii) Sharpening spatial filters.

11. a) What are the color models used for image representation? Explain. **6**

b) Explain the techniques which are used in color transformation. **7**

OR

12. Write short notes on **13**

i) Intensity to colour transformation

ii) Pseudo color image processing.

iii) Smoothing and sharpening.

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