

Please check whether you have got the right question paper.

- N.B:
1. Question No 1. Is compulsory.
 2. Attempt any three questions from remaining five questions.
 3. Assume suitable data if necessary and state it clearly.
 4. Figures to right indicate full marks.

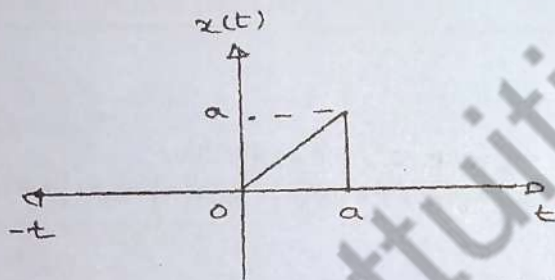
1. Answer **any four** questions from given questions. 20

(a) Explain any five types of elementary signals with mathematical equations and graphical plot.

(b) Find the fundamental period of the signal $x(t) = \sin\left(\frac{2\pi t}{6}\right) - \cos \pi t$

(c) Explain the application of Signals and System in Multimedia Processing.

(d) Find $x(-2t)$ and $x(3t + 2)$



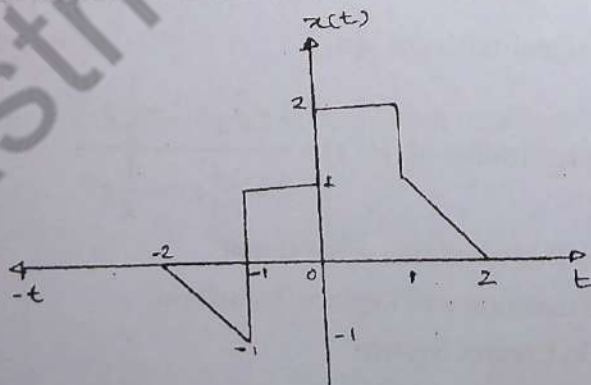
(e) Test the given system for linearity, causality, stability, memory and time variant.

$$y = x(t^2)$$

(f) If system matrix find the state transition matrix. $A = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix}$

2. (a) Sketch the following signals for the given signal shown. 10

- a) $x(-t)$ b) $x(2t + 5)$ c) $x(2t)$ d) $x(t/2)$ e) $-2x(t)$



(b) Using unilateral Laplace transform find the output of the system given by: where and

$$\frac{d^3 y}{dt^3} + 6 \frac{d^2 y}{dt^2} + 11 \frac{dy}{dt} + 6y(t) = x(t) \text{ where } x(t) = e^{-4t} u(t) \text{ \& } y(0^-) = 1, \left. \frac{dy}{dt} \right|_{t=0^-} = 1, \left. \frac{d^2 y}{dt^2} \right|_{t=0^-} = 1$$

3. (a) Find inverse Z-Transform of $X(z)$, $X(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}}$

(b) Given DT sequence:

$$x(n) = 0.4\delta(n+2) + 0.2\delta(n+1) + 0.1\delta(n) + 0.2\delta(n-1) + 0.4\delta(n-2)$$

Determine the following:

- $Xe^{j\omega}$
- $|Xe^{j\omega}|$
- Phase $\{X(e^{j\omega})\}$
- $\int_0^{2\pi} |X(e^{j\omega})|^2 d\omega$

4. (a) Determine the state model of the governed by the equation.

$$y[n] = -2y[n-1] + 3y[n-2] + 0.5y[n-3] + 2x[n] + 1.5x[n-1] + 1.5x[n-2] + 2.5x[n-3] + 4x[n-4]$$

(b) Find the Fourier transform of

$$x(t) = \begin{cases} \cos \pi t & -1/2 \leq t \leq 1/2 \\ 0 & \text{otherwise} \end{cases}$$

- From the definition of Fourier transform
- Using the convolution theorem of Fourier transform

5. (a) Determine DTFS for the sequence $x(n) = \cos^2((\pi/8)n)$

- Find Laplace transform of $\frac{d}{dt} \sin t u(t)$
- Find the Z Transform of signal $\cos(\omega_0 n) u[n]$

(c) Find the canonic (direct form II) realization of $H(z) = \frac{1 - 7/4 z^{-1} - 1/2 z^{-2}}{1 + 1/4 z^{-1} - 1/8 z^{-2}}$

6. (a) Find the autocorrelation function $R_{xx}(\tau)$ of sine wave signal.

(b) Explain the concept ROC in Z-Transform and Laplace Transform.

(c) Discuss applications of Signals in Control System.