

BT-4/M09

9331

Signal and System

Paper : EE-208-E

Time : Three Hours]

[Maximum Marks : 100

Note :- Attempt any FIVE questions.

UNIT-I

- (a) Explain periodic and aperiodic signals with examples.
- (b) Determine whether the following signal is periodic or not ?

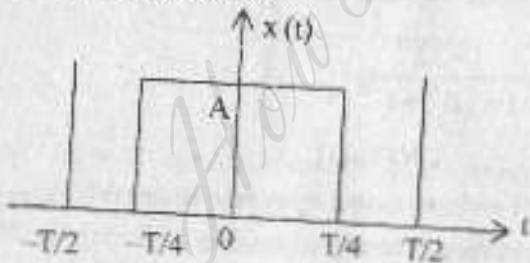
$$x(t) = \sin \sqrt{2} \pi t.$$

- (c) Determine the even and odd components of each of the following signal:

$$x(t) = 1 + t - 2t^2 + 5t^3 + 8t^4.$$

- (d) Given a complex-valued exponential signal $x(t) = Ae^{at}$ for $a > 0$.

- (a) Enumerate what are the Dirichlet's conditions. Following fig shows the periodic rectangular waveform. Obtain its Fourier Series representation.



- b) A damped sine wave is expressed as :

$$x(t) = e^{-\alpha t} \sin \omega t$$

Obtain Laplace transform of the signal.

(a) Explain and define cumulative distribution function (CDF) and explain its various properties. Also determine whether the following function is CDF :

$$F_x(x) = \begin{cases} 0 & \text{for } x < a \\ 1/2(x/a+1) & \text{for } -a \leq x \leq a \\ 1 & \text{for } x > a \end{cases}$$

(b) A joint probability density function of two random variables X and Y is given as :

$$f_{xy}(x,y) = \begin{cases} e^{-(x+y)} & \text{for } x \geq 0, y \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

determine the following :

- (i) P (X < 1)
- (ii) P (X > Y)
- (iii) P (X-Y < 1)

4. (a) State and explain sampling theorem for continuous-time signals. Also discuss zero order and first order hold. Also explain what is meant by Aliasing.

(b) Find the inverse Z-transform of :

$$X(z) = \frac{1-3z^{-1}}{1+\frac{1}{2}z^{-1}+z^{-2}}$$

UNIT-III

5. (a) Explain causal and non causal system with suitable examples.

(b) Explain the memory property of systems.

(c) Test the following system for linearity, time-in variance and causality.

- (i) $a(n) = b(-n + 5)$
- (ii) $a(n) = b(n) \sin(\omega_0 n)$

6. (a) Given a continuous-time (LTI) system with unit impulse response $h(t)$. A continuous-time signal $x(t)$ is applied to the input of this LTI system where :

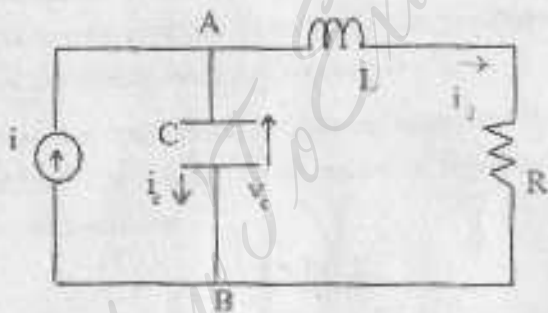
$$x(t) = e^{-at} \cdot u(t) \text{ for } a > 0$$

and $h(t) = u(t)$. Evaluate the output $y(t)$.

- (b) Write a Technical note on SIMO and MIMO system.

UNIT-IV

7. (a) Explain what is meant by State, State Variables and State Vectors. Discuss the State-Variable representation of an LTI system. Also explain the advantage of State Space method over traditional representation method.
- (b) Consider the network shown in fig. below. Obtain the state equation of the system.



8. (a) How is the response of LTI system determined for the deterministic and stochastic signal ?
- (b) Determine the response $y(n) \geq 0$ of the system described by the following difference equation. Also draw its state diagram.

$$y(n) - 2y(n-2) + 4y(n-4) = x(n) + 2 - 4x(n-1)$$

to the input $x[n] = 2^n u(n)$.