

S.No. : 166

No. of Printed Pages : 04

Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 33408

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B. Tech. Examination 2021-22**(Even Semester)****SIGNALS AND SYSTEMS****Time : Three Hours]****[Maximum Marks : 60****Note :-** Attempt all questions.**SECTION-A**

1. Attempt all parts of the following : $8 \times 1 = 8$

(a) Draw the waveform of the following signal :

$$x(t) = u(-2t + 1)$$

(b) Determine whether the system is time invariant or not :

$$y(n) = x(-n)$$

[P. T. O.]

- (c) Evaluate the step response for the LTI system represented by the following impulse response :

$$h(n) = \left(-\frac{1}{2}\right)^n u(n)$$

- (d) Determine whether the corresponding system is linear or non-linear $y(t) = t x(t)$.
- (e) Define Parseval's theorem.
- (f) Determine Nyquist rate for the signal :

$$x(t) = \sin c(200t)$$

- (g) Explain group delay and phase delay.
- (h) Write short note on white noise.

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

- (a) Determine whether the unit step function is energy signal or power signal.

- (b) Find the convolution of the two sequences :

$$x(n) = \begin{cases} 0 & , n < -5 \\ \left(\frac{1}{2}\right)^n & , n \geq -5 \end{cases} \quad \text{and} \quad n(n) = \begin{cases} 0 & , n < 3 \\ \left(\frac{1}{3}\right)^n & , n \geq 3 \end{cases}$$

- (c) Find the Fourier transform of the signum function $x(t) = \text{sgn}(t)$:

$$\text{sgn}(t) = \begin{cases} -1, & t < 0 \\ 0, & t = 0 \\ 1, & t > 0 \end{cases}$$

- (d) Find and sketch the auto correlation function $R_{xx}(\tau)$ for $x(t) = e^{-at} u(t)$, $a > 0$.

SECTION - C

Note :- Attempt all questions. Attempt any two parts from each questions.

$$5 \times 8 = 40$$

3. (a) Find the even and odd components of the signal :

$$x(t) = e^{-2t} \cos(t)$$

- (b) Determine whether the corresponding system is causal :

$$y(t) = \sin x(t)$$

- (c) Explain the properties of continuous-time unit impulse function.

[P. T. O.]

4. (a) Suppose the unit impulse response of an LTI system is a unit ramp $h(n) = r(n) = n u(n)$. Compute the response of this system to a unit step input $x(n) = u(n)$.
- (b) Explain BIBO stability in a system.
- (c) Prove the following convolution integral :

$$x(t) * u(t) = \int_{-\infty}^t x(\tau) d\tau$$

5. (a) Find the CTFT of:

$$x(t) = e^{-at}, a > 0$$

- (b) Determine the signal $x(n)$ for the following given discrete time Fourier transform :

$$x(e^{j\omega}) = e^{-j\omega} \text{ for } \omega_c \leq \omega \leq \omega_c$$

- (c) Explain in detail various sampling techniques.
6. (a) Explain energy spectral density in detail.
- (b) State the properties of crosscorrelation function.
- (c) Explain different types of noises.
