Course: B. Tech in Electrical Engineering **Sem: IV**

Subject Code: BTEEPE405B

Subject Name: Signals & System

Unit-1

(1) Find the energy and power of following Signal/Sequence

(i) $x[n] = 2^n u[-n]$

(ii) $x(t) = Rect\frac{t}{T}$

(iii) $\int_{-\infty}^{\infty}\{\delta(t)Cos2t + \delta(t-2)Sin2t\}dt$

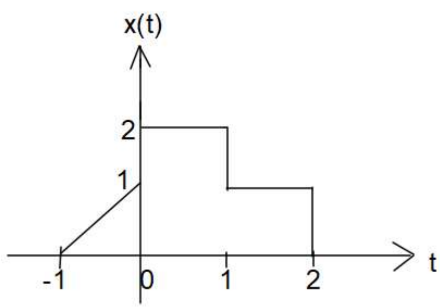
(iv) $\int_{-0}^{2\pi}\{t\ Sint\ \delta\left(\frac{\pi}{2} - t\right)\}dt$

(2) Sketch the following signals:

(i) u[n+2] u[-n+3] **(ii)** -2u(t+2) **(iii)** π (t-2)

(3) If X[n] = {1,2,**3**,4,1}, then: Find x[2n-3] and plot x[2n/3] and plot x[-2n]

(4) Plot $x(2t+1)$ and $x(2-3t)$ from the following signal:



(5) Check for the periodicity of following signals and find the fundamental time period if they are periodic:

(i) x[n] = $e^{j2\pi n+2}$

(ii) x(t) = 2+ sin(2t) + cos(3πt)

(iii) x(t)= 2u(t) + $Sin^{2(}$3πt)

(iv) x(n)= $(½)^n$u[n]

Unit-2

1. Define systems. Write the properties of the systems.

2. Check the following systems for Static/Dynamic/Causal/Non-Causal

(i) $y[n] = 2x[n+1] + 3x[n] - x[n-1]$ **(ii)** $y(t) = \frac{dx(t)}{dx} + x^2(t) + x(t+1)$

3. Explain the process of checking linearity property of the system in detail.

4. Check whether the following systems are Stable/Unstable.

(i) y(t) = t.x(t)
(ii) y(t) = u(t) + 2
(iii) y(t) = sin(t).u(t)
(iv) y(t)= x(t)/t

5. Describe the causal and non-causal systems

Unit-3

1. Define transfer function and write the properties of LTI system.

2. write the properties of convolution.

3. Find the convolution of following signals

(i) x(t) = u(t)-u(t-2) and y(t) = u(t)- u(t-1)
(ii) x(t) = rect(t/T) and y(t) = Δ(t/T)
(iii) x(t) = u(t+5) and y(t) = δ(t-7)
(iv) x(t) = u(t) and y(t) = 2u(t+2)-3u(t+1)+u(t-2)

4. How the causality and stability of the system can be checked by impulse response of the system explain in detail.

Unit-4

1. Find the Laplace transform of following signals and define ROC.

(i) x(t)= u(t). $e^{(-2t+1)}$
(ii) x(t)= sin2t. e^{2t}. u(2t)
(iii) x(t)= u(t)- u(2t-1)
(iv) x(t)=[t^2+3t-7]. u(t-1)
(v) x(t) = t. sint. u(t)

2. Find the impulse response in time domain of the following systems, if systems are stable and causal.

(i) H(S) = ln $(\frac{S+5}{S+6})$
(ii) H(S)= $\frac{2S+5}{S^2+5S+6}$
(iii) H(S)= $6S^2 + 1$

3. Consider a Continuous time LTI system for which input x(t) and output y(t are related by the following differential equation

$$\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$$

Determine h(t)

(1) When system is Causal
(ii) When the system is stable
(iii) When the system is neither causal nor stable

4. Find Z- transform of following signals, and comment on ROC.

(i) x[n] = {1,**2**,3}
(ii) x[n] = 3^n u[n] - 2^n u[-n-1]
(iii) x[n] = Sgn [n]
(iv) x[n] = $2^{|n|}$
(v) x[n] = $(½)^n$ u[-n-1]

5. Consider a LTI system with following input output relationship:
Y[n]= (½). y[n-1] = x[n]- 2 x [n-1]
Calculate:

(i) system function.
(ii) output y[n] for input x[n] = u[n]

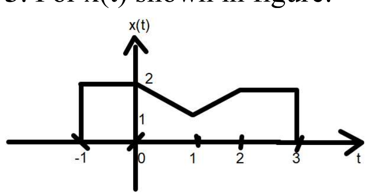
Unit-5

1. Derive the relation between Laplace transform and Fourier transform.

2. Find the Fourier transform of following signals and plot the magnitude and Fourier spectrum:

(i) x(t) = e^{-at} u(t) ; a>0
(ii) x(t) = e^{at} u(-t) ; a>0
(iii) x(t) = δ(t)
(iv) x(t) = A.Rect(t/T)
(v) x(t) = sgn(t)

3. For x(t) shown in figure:



Find:

(i) $\int_{-\infty}^{\infty} X(\omega)d\omega$
(ii) X(o)
(iii) $\int_{-\infty}^{\infty} X(\omega)e^{j4\omega}d\omega$

4. Let x(t) be a periodic signal with fundamental time period ‘T’ and fourier series coefficient a_k. Derive the fourier series coefficient of each of the following signals in terms of a_k.
(i) $x(t-t_0)+x(t+t_0)$
(ii) Even{x(t)}
(iii) Real{x(t)}
(iv) x(3t-1)

5. Find Fourier series coefficient of x(t) = $\sum_{m=-\infty}^{\infty} \delta(t - mT)$