VIT
Vellore Institute of Technology

Continuous Assessment Test – I

Programme Name & Branch: B. Tech., ECE

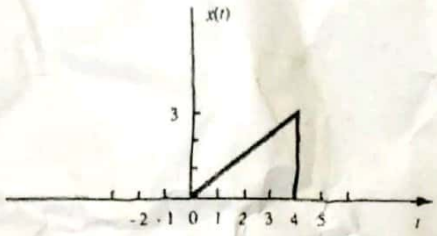
Course Name & Code: ECE1004: Signals and Systems

Class Numbers: 3085/ 1527 **Slot:** B2 **Duration:** 90 mins **Max. Marks:** 50

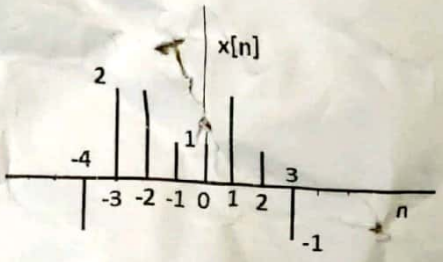
Answer ALL the questions (10 x 5 = 50 Marks)

1. i) A continuous-time signal $x(t)$ is shown in the Figure below. Sketch and label each of the following signals: [5]

a. $x(t-2)$ b. $x(2t)$ c. $x(t/2)$ d. $x(-t)$



ii) Determine and sketch the even and odd parts of the $x[n]$ shown below: [5]



2. i) Determine whether or not each of the following signals is periodic. If a signal is periodic, then determine its fundamental period. [5]

a. $x[n] = e^{j(\pi/4)n}$

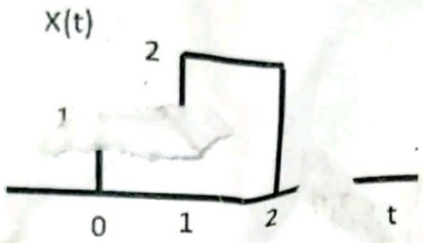
b. $x(t) = \cos t + \sin \sqrt{2}t$

ii) Determine whether each of the following signals is an energy signal, power signal or neither and also compute the corresponding energy or power: [5]

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

b. $x[n] = (-0.5)^n u[n]$

3. Represent X(t) in terms of standard signals and write the equation for the first derivative of the signal shown below and sketch it.



4. Determine, whether the following Systems, modelled by their respective and corresponding Input - Output Equations (given) are: (i) Static / Dynamic; (ii). Causal / Anti-Causal; (iii) Linear / Non-Linear; (iv) Time-Invariant / Time- Varying; (v) Stable / Unstable:

a. $y(t) = \frac{dx(t)}{dt}$ [5]

b. $y(n) = x(n+1) - x(n-1)$ [5]

5. Let f(x) be a function of period 2π such that

$$f(x) = \begin{cases} 1, & -\pi < x < 0 \\ 0, & 0 < x < \pi \end{cases}$$

a. Sketch a graph of f(x) in the interval $-2\pi < x < 2\pi$

b. Show that the Fourier series for f(x) in the interval $-\pi < x < \pi$ is

$$\frac{1}{2} - \frac{2}{\pi}\left[\sin x + \frac{1}{3}\sin 3x + \frac{1}{5}\sin 5x + \ldots\right]$$

c. By giving an appropriate value to x, show that

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \ldots$$