S/K/TY

Reg. No: 24BEC03

VIT
Vellore Institute of Technology

Final Assessment Test – November 2025

Course: BECE202L - Signals and Systems

Class NBR(s): 0448 / 2647 / 2648 / 2650 / 3478 / 3489 Slot: B1+T

Time: Three Hours Max. Mar

KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED A MALPRACTICE

DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Differentiate between various types of signals and understand the implication of operati signals.
CO2	Understand terms like causal, dynamic, linear, time invariant and stability of systems; als compute impulse response of both continuous-time and discrete-time systems.
CO3	Perform transformation of CT and DT signals from time domain to frequency domain and understand the concept of distribution of energy as a function of frequency.
CO4	Convert CT signals to DT signals and vice versa, and understand their consequences.
CO5	Process bandpass signals through bandpass systems.
CO6	Solve differential and difference equations, with initial conditions, using Laplace and Z tra respectively.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – C

Answer ALL Questions
(10 X 10 = 100 Marks)

1. For the signal $x(t)$ shown in Fig.1., draw the following signals; CO1

(a) $x(2t+2)$ [3]

(b) $x(0.5t-2)$ [3]

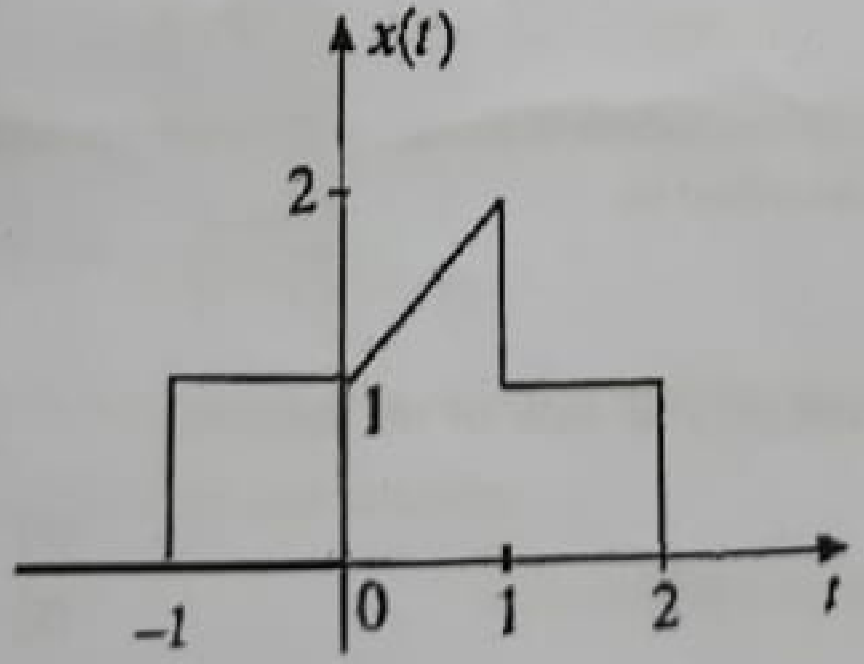

Fig.1

(c) Find the even and odd component of the signal [4]

$x(t) = \cos(\omega t + \pi)$

2.	Test the Causality, Linearity, stability, Memory and Time Variant of the discrete time system given below. $y[n] = x[n^2]$	[10]	CO1	BL2
3.	Determine the output y(n) of an LTI system with impulse response, $h[n] = a^n u[n]$ using graphical approach ; where $\|a\| < 1$ and input is a unit step sequence, i.e., x[n] = u[n].	[10]	CO2	BL2
4.	Find the exponential Fourier Series and plot the magnitude and phase spectra of the following triangular waveform shown in Fig. 2.	[10]	CO3	BL2

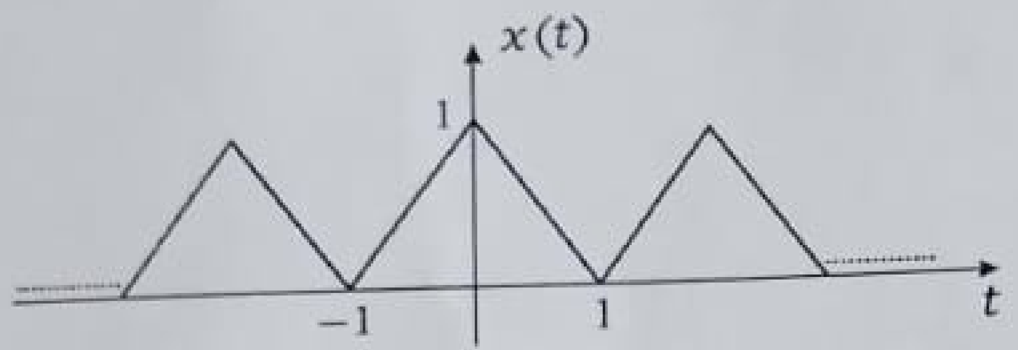

Fig 2

5.(a) Consider a discrete-time LTI system described by CO3 BL3

$$y[n] - \frac{1}{2}y[n-1] = x[n] + \frac{1}{2}x[n-1]$$

(i) Using Fourier transform, determine the frequency response $H(e^{j\omega})$ of the system. [3]

(ii) Find the impulse response $h[n]$ of the system. [3]

(iii) Determine its response $y[n]$ to the following input signal [4]

$x[n] = u[n]$

OR

5.(b) Consider a continuous-time LTI system described by CO3 BL3

$$\frac{dy(t)}{dx} + 2y(t) = x(t)$$

Using Fourier Transform, find the output $y(t)$ to each of the following inputs signals:

(i) $x(t) = e^{-t}u(t)$ [5]

(ii) $x(t) = u(t)$ [5]

6. i) Find the inverse Fourier transform of [5] CO3 BL3

$$X(j\Omega) = \frac{j\Omega}{(3+j\Omega)^2}$$

ii) Let the Fourier transform x(t) be $X(j\Omega)$. Using Fourier transform properties, find the Fourier transform of the following [5]

a) $x(t) = x(2-t) + x(-2-t)$

b) $x(t) = x(2t-3)$

7. i) Find the Hilbert transform of the signal $x(t) = e^{-|t|}$ and sketch both $x(t)$ and its Hilbert transform $\hat{x}(t)$. [5] CO5 BL2

ii) Prove that the Hilbert transform introduces a phase shift of -90° for positive frequencies and $+90^\circ$ for negative frequencies using an example. [5]

8. a) The sequence $x[n] = cos\left(\frac{n\pi}{4}\right)$ was obtained by sampling a continuous-time signal $x(t) = \cos(\Omega_o t)$ at a sampling rate of 1000 samples/second. What are the two possible values of Ω_o that could have resulted in the sequence $x[n]$ mentioned above. [5] CO4 BL3

b) The continuous-time signal $x(t) = \cos(4000\pi t)$ is sampled at regular time intervals of T_s to obtain $x[n] = cos\left(\frac{n\pi}{3}\right)$. Determine a choice for T_s consistent with the given information. Is your choice of T_s unique or could there be other values that satisfy the given requirements. [5]

9. i) Find the Laplace transform using properties of the following and find the ROC? [5] CO6 BL3

$$x(t) = 2e^{-6t}u(t) - 10e^{4t}u(-t)$$

ii) Find the inverse Laplace transform of $X(s) = \frac{1}{s(s+1)(s+2)(s+3)}$ [5]

for the ROC's

a) Re(s) > 0
b) Re(s) < -3

10.(a) Determine $x[n]$ of $X(z) = \log(1 + az^{-1})$ via inverse Z-transform with ROC $|Z| > |a|$. [10] CO6 BL3

OR

10.(b) A discrete-time LTI system is characterized by the system function [10] CO6 BL3

$$H(z) = \frac{3-4z^{-1}}{1-\frac{7}{2}z^{-1}+\frac{3}{2}z^{-2}}$$

Determine the impulse response $h[n]$ for the possible ROCs and comment on the stability and causality.

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