T/K/TY

Reg. No:

VIT Vellore Institute of Technology

Final Assessment Test – November 2025

Course: BEEE204L - Signals and Systems

Class NBR(s): 1031 / 1032 Slot: B2+TB2

Time: Three Hours Max. Marks: 100

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Perform signal transformations on continuous and discrete - time signals and systems
CO2	Apply convolution integrals and convolution sums to obtain response of LTI systems
CO3	Apply frequency domain techniques to obtain steady state response of the continuous and discrete time LTI system.
CO4	Ability to elucidate the limitations of discrete representations of continuous time signals using sampling theorem.
CO5	Apply Laplace and Z-Transform techniques to analyze LTI systems.

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

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Calculate the Energy and Power of the following signals. Classify each signal as Energy, Power or neither with proper justification. CO1 BL3
   i) $x(t) = u(t+1) - u(t-1)$ where u(t) is the unit step signal
   ii) $x[n] = 3e^{j2n}$

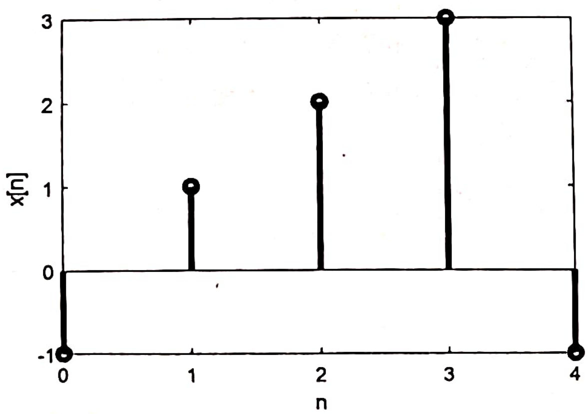
2. i) Determine if the signal CO1 BL3

$$x[n] = 3\sin(\frac{37\pi n}{2})$$

   is periodic and if periodic determine its fundamental period.

   ii) Determine whether the system defined by $y(t) = x(\sin(t))$ is Linear, Time-invariant, Memoryless, Causal and stable. Provide justification based on the definition of each property.

3. Neatly sketch $x[n+2]$, $x[3n]$ and $x[1-n]$ where x[n] is the signal shown below: CO1 BL2



4.	Convolve the signals $x_1[n]$ and $x_2[n]$ using the graphical convolution method: $x_1[n] = \{1, -1, 1, 1\}$ $x_2[n] = \{1, 0, 2, 3\}$ Assume that the above signals start at n = 0.	CO2	BL3
5.	Compute the Complex Exponential Fourier Series coefficients for the periodic signal with fundamental period T_0 = 2 s defined by: $x(t) = \begin{cases} 3 & for \quad 0 \le t \le 1 \\ -3 & for \quad 1 < t \le 2 \end{cases}$	CO2	BL4
6.	Compute the Fourier Transform of i) $x(t) = e^{-2\|t\|}$ ii) $x[n] = n\left(\frac{1}{2}\right)^n u[n]$	CO3	BL4
7.a)	A causal LTI system is described by the differential equation $\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 12y(t) = x(t)$ where x(t) is the input and y(t) is the output of the system. Obtain the impulse response of the system using the Fourier transform.	CO3	BL4
	OR		
7.b)	Obtain the inverse Fourier transform of $X(j\omega) = \frac{j\omega + 2}{(j\omega)^2 + 4(j\omega) + 3}$	CO3	BL4
8.	Discuss Sampling of a continuous time signal in detail with appropriate figures. Explain the phenomenon of Aliasing.	CO4	BL2
9.	Solve the following differential equation using the Laplace transform for t > 0: $\frac{d^2y}{dt^2} + 9\frac{dy}{dt} + 20y = e^{-t}u(t)$ Assume that $y'(0) = y(0) = 0$.	CO5	BL3
10.a)	Find the Z transform and neatly sketch the pole-zero plot and Region of Convergence of the sequence: $x[n] = \left(\frac{1}{3}\right)^n u[n] + \left(\frac{1}{2}\right)^n u[-n-1]$	CO5	BL4
	OR		
10.b)	Find the inverse Z transform of X(z) given below using the partial fraction method: $X(z) = \frac{z}{(z)(z-1)(z-2)^2} \quad for \quad \|z\| > 2$	CO5	BL4

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