Sub Code: R2321042 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM
II B. Tech I Semester Regular/Supply Examinations, November – 2025
SIGNALS AND SYSTEMS
(ECE)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.

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PART-A **(20 Marks)**

1	a)	What are the basic operations that can be performed on signals.	[2]
	b)	What is meant by Hilbert space in the context of signal representation.	[2]
	c)	Differentiate between convolution integral and convolution sum.	[2]
	d)	State and explain the stability condition for an LTI system.	[2]
	e)	What is the convolution theorem for Fourier Transform.	[2]
	f)	Explain in one line the purpose of the Hilbert Transform in communication systems.	[2]
	g)	Define the Laplace Transform and state its basic formula.	[2]
	h)	What is the difference between Bilateral and Unilateral Z-Transform.	[2]
	i)	Define aliasing and mention how it can be avoided.	[2]
	j)	Write the mathematical condition for perfect reconstruction of a sampled signal.	[2]

PART-B **(50 Marks)**

Unit-1

2 Distinguish between the following with neat sketches. [10]
i.) Continuous time signal and discrete time signal ii.) Unit step and Unit Ramp functions.
iii.) Periodic and Aperiodic Signals. iv.)Deterministic and Random Signals.

(OR)

3	a)	Discuss the analogy between vectors and signals. Explain how concepts like magnitude, inner product, and orthogonality apply to signals.	[5]
	b)	State and prove the Schwartz inequality for signals.	[5]

Unit-2

4	a)	What is Impulse Response? Show that the Response of an LTI system is convolution Integral of its impulse Response with input signal.	[5]
	b)	Obtain the convolution of the following two signals. X(t)= u(-t) ; h(t) = u(t-3).	[5]

(OR)

5	a)	Discuss the characterization of LTI systems using impulse response.	[5]
	b)	Given an input signal $x(t)=e^{-2t}u(t)$ and the impulse response $h(t)=e^{-t}u(t)$, find the output y(t) of the system using the convolution integral**.**	[5]

Unit-3

6	a)	Find the Fourier Transform of $x(t)=e^{-a\|t\|}$,a>0 and sketch its magnitude spectrum.	[5]
	b)	Explain the relationship between DTFT and Discrete Fourier Transform (DFT). Why is DFT considered a sampled version of DTFT.	[5]

(OR)

7 Explain in detail the properties of Continuous-Time Fourier Series (CTFS) such as linearity, time shifting, frequency shifting, and conjugate symmetry. [10]

Unit-4

8	a)	Find the Laplace Transform of $x(t)=e^{-3t}u(t)$ and specify the Region of Convergence (ROC).	[5]
	b)	Compute the Inverse Laplace Transform of : $X(s)= 5/(s^2+4s+5)$.	[5]

(OR)

9 Derive the Laplace Transform from the Fourier Transform and explain how it extends the concept of frequency domain analysis for unstable signals. [10]

Unit-5

10 Derive the sampling theorem for low-pass (baseband) signals analytically and explain each step clearly. [10]

(OR)

11 a) Explain the role and design considerations of an anti-aliasing filter in practical signal acquisition systems. [5]

b) A continuous-time signal $x(t)=\cos(2000\pi t)+\cos(6000\pi t)$ is sampled. Find the minimum sampling frequency required to avoid aliasing. [5]

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