GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV EXAMINATION – SUMMER 2025

Subject Code:2141005   **Date:23-05-2025**

Subject Name:Signals and Systems

Time:10:30 AM TO 01:00 PM   **Total Marks:70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

		MARKS

Q.1 **(a)** Define a signal and explain the types of signals.   **03**

(b) Discuss the properties of continuous-time and discrete-time signals.   **04**

(c) Describe the significance of linearity and time-invariance in system engineering.   **07**

Q.2 **(a)** Define the impulse function and its properties.   **03**

(b) Discuss the concept of convolution in the context of continuous-time and discrete-time signals.   **04**

(c) Compute the convolution of the following continuous-time signals: **07**
$x1(t) =1, 0 \leq t <3$
      0, otherwise
$x2(t) = 1, 0 \leq t <1$
        0, otherwise
Show all the steps of the calculation.

OR

(c) Use convolution to determine the output of the given LTI system for the given input x[n]: Show all the steps of the calculation.   **07**
$x[n]=\{1,2,1,2\}$ and impulse response $h[n]=\{2,1,2,1\}$.

Q.3 **(a)** Derive the Fourier transform of the given continuous-time signal: **03**
$x(t) =e^{-at}u(t)$

(b) Describe the concept of Fourier series and its application in representing periodic signals. Provide a numerical example to illustrate the Fourier series expansion.   **04**

(c) Discuss the method to solve difference equation using Z transform   **07**

OR

Q.3 **(a)** Define the z-transform and ROC   **03**

(b) Prove any two properties of the z-transform.   **04**

(c) Find the inverse Z transform of the given discrete-time system represented by the transfer function using long division.   **07**
$H(z) =z/(z-0.5)$

Q.4 **(a)** Define the Laplace transform and discuss its advantages.   **03**

(b) Derive the Laplace transform of the given continuous-time signal: **04**
$x(t) = \sin\{at\}u(t)$
Show all the steps of the calculation.

(c)   **07**
$x(t)=t$ for $0 \leq t <2$
0, otherwise
Determine the signal's energy and power.

<div align="center">**OR**</div>

Q.4	**(a)**	Define Nyquist rate and explain how to avoid aliasing.	**03**
	(b)	For signal frequency of 1KHz find sampling frequency	**04**
	(c)	State and prove sampling theorem, with all necessary equations and diagrams	**07**

Q.5	**(a)**	Find DTFT of sequence x[n]={1,2,1,1}	**03**
	(b)	Prove any two property of DTFT	**04**
	(c)	Prove convolution property of Z -transform	**07**

<div align="center">**OR**</div>

Q.5	**(a)**	Define periodicity of continuous and discrete time signal	**03**
	(b)	Differentiate between digital and analog frequency	**04**
	(c)	Check Linearity, Causality and Time invariance properties of system Y=mx+c	**07**

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