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

Subject Code:3141005   **Date:12-05-2025**

Subject Name: Signal & 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.**

Q.1	**(a)**	Explain Energy and Power signals.	**03**
	(b)	Define: System Determine whether the system $y(t) = tx(t)$ is 1. Causal or Non-Causal 2. Time-variant or Time-invariant 3. Static or Dynamic	**04**
	(c)	Explain properties of continuous time and discrete time systems.	**07**
Q.2	**(a)**	State and explain associative property of convolution sum.	**03**
	(b)	Find the natural response of the system described by difference equation $y(n) - 1.5y(n-1) + 0.5y(n-2) = x(n)$ $y(-1) = 1 \quad and\, y(-2) = 0$	**04**
	(c)	Determine the convolution integral of $x(t) = 1 \quad for - 1 \le t \le 1 \quad and\, h(t) = 1 \quad for\ 0 \le t \le 2$	**07**

OR

	(c)	Compute the convolution sum $y(n) = x(n) * h(n)$ 1. $x(n) = \delta(n) - \delta(n-2) \quad and \quad h(n) = u(n)$ 2. $x(n) = u(n) \quad and \quad h(n) = u(n)$	**07**
Q.3	**(a)**	State and prove time shifting property of Fourier transform.	**03**
	(b)	Determine whether the following system with impulse response $h(n) = 2^n u(-n)$ is stable or not.	**04**
	(c)	Compute the Fourier transform of $x(n) = (1)^n u(n)$. Also give applications of Fourier transform.	**07**

OR

Q.3	**(a)**	State and prove time scaling property of Fourier transform.	**03**
	(b)	State and prove a condition for a discrete time LTI system to be stable.	**04**
	(c)	Enlist and explain properties of Fourier transform.	**07**
Q.4	**(a)**	Determine the Z – Transform & ROC of the following sequence $x(n) = 3^n u(n) - 4^n u(n)$.	**03**
	(b)	Find DTFT of the sequence $x(n) = \{1,0,2,3\}$.	**04**
	(c)	Using partial fraction method, determine the sequence that goes with the following z-transforms: $X(z) = 3/z - \frac{1}{4} - \frac{1}{8} z^{-1}$ and $x(n)$ is absolutely summable.	**07**

OR

Q.4 **(a)** Find the z-transform of the signal $x(n) = \left(-\frac{1}{5}\right)^n u(n) + 5\left(\frac{1}{2}\right)^n u(-n-1)$. **03**

(b) Explain the time shifting property of Fourier Transform. **04**

(c) Using partial fraction expansion find the inverse z-transform of **07**
$$X(z) = 1 - \frac{1}{3}z^{-1} \big/ (1 - z^{-1})(1 + 2z^{-1}), \quad |z| > 2$$

Q.5 **(a)** Find 4-point DFT of the sequence $x(n) = \{1, 3, 4, -2\}$. **03**

(b) List out the difficulties faced during signal reconstruction. **04**

(c) State and prove differentiation property of z-transform. **07**

OR

Q.5 **(a)** Explain aliasing effect. **03**

(b) Explain signal reconstruction using interpolation technique. **04**

(c) State and prove Sampling theorem. **07**

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