Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV EXAMINATION – WINTER 2025

Subject Code:3141005 Date:15-11-2025

Subject Name:Signal & Systems

Time:02:30 PM TO 05:00 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)**	Define periodic & nonperiodic signal. Determine which of the following signals are periodic. (a) $x_1(t) = sin15\pi t$ (b) $x_2(t) = sin20\pi t$	**03**
	(b)	Explain energy signal and power signal. Obtain energy of $x(n) = a^n u(n)$ where $\|a\| \leq 1$.	**04**
	(c)	Determine whether the system given as $y(t) = 5x(t) + 2$ is Static, Causal, Linear, or Time invariant?	**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 sum of two sequences using graphical method $x(n) = \{1, 4, 3, 2\}; \quad h(n) = \{1, 3, 2, 1\}$ $\uparrow \qquad\qquad \uparrow$	**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 $x(n) = 3^n u(n) - 4^n u(-n-1)$.	**03**
	(b)	Determine 2-point DFT of a sequence, $x(t) = u(n) - u(n-2)$.	**04**
	(c)	Find the inverse Z-transform of $X(z) = 1/(1 - 1.5z^{-1} + 0.5z^{-2})$ for (a) ROC: $\|z\| \geq 1$ and (b) ROC: $\|z\| < 0.5$	**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**

$$X(z) = 1 - \frac{1}{3}z^{-1}/(1 - z^{-1})(1 + 2z^{-1}) \ , \quad |z| > 2$$

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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