Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:3141005   **Date:11-07-2023**
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.**

			MARKS
Q.1	**(a)**	State Dirichlet condition for Fourier Series Representation.	**03**
	(b)	Prove the duality property of Fourier Transform.	**04**
	(c)	Explain reconstruction of a signal from its samples using interpolation.	**07**
Q.2	**(a)**	List out properties of convolution.	**03**
	(b)	Obtain the relationship between Laplace transform and Fourier Transform.	**04**
	(c)	Obtain Z-Transform of $x(n) = n^2 u(n)$ and $x(n) = (-2)^n u(-n-1)$	**07**
		OR	
	(c)	Classify signals. Give examples of each.	**07**
Q.3	**(a)**	Find the even and odd components of $x(t) = \cos(t)\sin(t)$	**03**
	(b)	Write a short note on zero order hold with its application.	**04**
	(c)	Compute DFT of the sequence, $x[n] = \{1,2,3,4\}$ using its definition.	**07**
		OR	
Q.3	**(a)**	Find the Fourier Transform of $x(t) = e^{-3t}u(t)$.	**03**
	(b)	Define R.O.C. of Z-Transform. Write its properties.	**04**
	(c)	A system is described by difference equation $y(n) = 0.5y(n-1) + x(n)$. Input given to system is $(1/3)^n u(n)$ and initial condition is $y(-1) = 1$. Determine the zero state response.	**07**
Q.4	**(a)**	State & prove a condition for a discrete time LTI system to be stable.	**03**
	(b)	Prove Commutative property of convolution.	**04**
	(c)	Determine the Inverse Z-Transform of $$X(Z) = \frac{\frac{1}{4}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)} \qquad ROC : |Z| > \frac{1}{2}$$	**07**
		OR	
Q.4	**(a)**	Prove that a DT LTI system is causal if and only if $h(n) = 0$ for $n<0$.	**03**
	(b)	Find the Fourier Transform of the periodic signal $x(t)=\cos(2\pi ft)u(t)$	**04**
	(c)	Determine Inverse Z-Transform of $$X(z) = \frac{1}{(1 + z^{-1})(1 - z^{-1})^2} \;,ROC : |z| > 1$$	**07**
Q.5	**(a)**	Obtain DFT of unit impulse $\delta(n)$.	**03**
	(b)	State and prove differentiation property of Z-Transform.	**04**
	(c)	Explain the properties of continuous time and discrete time systems	**07**
		OR	
Q.5	**(a)**	Compare Energy and Power signal.	**03**
	(b)	State and prove time scaling property of Fourier Transform.	**04**

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(c) Obtain x(n) using long division method for **07** $X(Z) = \frac{z}{z-1}$ for both possible ROCs.

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