Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3141005 Date:17-01-2024

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)**	Find discrete Convolution of following pairs of signals. and x(n) = {1,3,5,7} and h(n) = {2,4,6,8}	**03**
	(b)	Prove Commutative property of Convolution.	**04**
	(c)	What is ROC with respect to z- transform? What are its properties?	**07**
Q.2	**(a)**	Find the DFT of the sequence x(n) = {1, 1, -2, -2}	**03**
	(b)	Enlist frequency shifting and time differentiation properties of Fourier transform. Prove any one of them.	**04**
	(c)	State the sampling theorem. Also explain the reconstruction of a signal from its samples using interpolation.	**07**
		OR	
	(c)	Determine the Z – Transform & ROC of the following sequence $x(n) = (3)^n u(n) - (2)^n u(-n-1)$	**07**
Q.3	**(a)**	Explain Scaling property in the z -Domain.	**03**
	(b)	State Dirichlet condition for Fourier Series Representation	**04**
	(c)	Determine the convolution sum of two sequences using graphical method x(n) = {1, 4, 3, 2}; h(n) = {1, 3, 2, 1} ↑ ↑	**07**
		OR	
Q.3	**(a)**	Find even and odd parts of $x(t)=u(t)$.	**03**
	(b)	Bring out difference between DFT and Fourier Transform (FT).	**04**
	(c)	Explain following property for the system y(t) = 10 x(t) + 5. (i) Linearity (ii) Time-invariance (iii) Causality (iv) Dynamicity	**07**
Q.4	**(a)**	Explain the trigonometric Fourier series.	**03**
	(b)	Define energy and power. Hence, define energy signal and power signal.	**04**
	(c)	Calculate the DFT of a sequence $x[n]=\{1,1,0,0\}$ and check the validity of DFT by calculating its IDFT.	**07**
		OR	
Q.4	**(a)**	Explain the Differentiation property of Z-Transform.	**03**
	(b)	Determine whether the following system with impulse response $h(t) = e^{-3t} u(t)$ is stable or not.	**04**
	(c)	Find the Fourier series coefficients for the continuous time periodic signal x(t) = 1.5 for $0 \le t < 1$ = -1.5 for $1 \le t < 2$ with fundamental frequency $W_0 = \pi$.	**07**

Q.5	**(a)**	State and prove a condition for a discrete time LTI system to be stable.	**03**
	(b)	Find the natural response of the system described by difference equation $y(n) - 1.5\, y(n-1) + 0.5\, y(n-2) = x(n)$; $y(-1) = 1$; $y(-2) = 0$.	**04**
	(c)	Obtain the Fourier Transform of following signals: 1. $x(t) = \cos\omega_0 t$ 2. $x(t) = \sin\omega_c t\ u(t)$	**07**

OR

Q.5	**(a)**	Explain relation between Fourier transform and z transform using necessary equations.	**03**
	(b)	Prove that DT LTI system is causal if and only if $h(n) = 0$ for $n < 0$.	**04**
	(c)	Find whether the given signals are periodic or not? If yes, give its fundamental period. (i) $x(t) = 3 \sin 200\pi t + 4 \cos 100t$ (ii) $x(n) = e^{j(\pi/2)n}$	**07**

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