Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(NEW) EXAMINATION – WINTER 2022

Subject Code:3141005 **Date:14-12-2022**

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)**	Compare Energy and Power Signals.	**03**
	(b)	If the given signal $x(t) = e^{-at}u(t)$. Draw the signals: $x(-t+2)$ and $x(-t-3)$.	**04**
	(c)	Determine whether the following systems are : (1) Memoryless (2) Causal (3) Stable (4)Time Invariant (5) Linear. (I) $y(t) = x(0.5t)$ (II) $y[n] = x[n-1] + x[n]$.	**07**
Q.2	**(a)**	State and prove a condition for a discrete time LTI system to be stable.	**03**
	(b)	Find the step response of the system whose impulse response is : (1) $\delta[n+2] + \delta[n-3]$ (2) $u[n]$	**04**
	(c)	Obtain convolution integral of : $x(t) = 1 \ for \ -1 \leq t \leq 1$ and $h(t) = 1 \ for \ 0 \leq t \leq 2$	**07**
		OR	
	(c)	Obtain linear convolution of two discrete time signals given as : $x[n] = u[n]$ and $h[n] = a^n u[n], a < 1$.	**07**
Q.3	**(a)**	Give the difference between DFT and DTFT.	**03**
	(b)	Obtain Fourier Transform of a Unit Step Function.	**04**
	(c)	State convolution property of Fourier Transform and find Fourier Transform of the following signal : $y(t) = e^{-at}u(t) * u(t)$.	**07**
		OR	
Q.3	**(a)**	Define DFT and IDFT.	**03**
	(b)	Determine complex exponential Fourier series of $\cos(\omega_0 t)$	**04**
	(c)	Determine the trigonometric Fourier Series of : $\delta_{T_0}(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT_0)$	**07**
Q.4	**(a)**	Define Sampling Theorem.	**03**
	(b)	Find the Nyquist rate and interval of $x(t) = 5\cos 1000\pi t \cos 4000\pi t$.	**04**
	(c)	State and Prove Time Shifting Property of Fourier transform.	**07**
		OR	
Q.4	**(a)**	What is aliasing? How can we eliminate Aliasing?	**03**
	(b)	A bandpass signal has a spectral range that extends from 20 kHz to 82 kHz. Find the sampling frequency.	**04**
	(c)	Define the continuous time Fourier Transform. State and prove Duality property of Fourier Transform.	**07**
Q.5	**(a)**	State and prove Time Shifting Property of z Transform.	**03**
	(b)	Determine z Transform of following sequences : (1) $x[n] = \alpha^{-\lvert n \rvert}, 0 < \alpha < 1$ (2) $x[n] = 2^n u[n] + 3^n u[-n-1]$	**04**

	(c)	Find the convolution of the signal using z Transform. $x_1[n] = a^n u[n]$, $a < 1$ and $x_2[n] = u[n]$	**07**

OR

Q.5	**(a)**	State and prove Time Reversal Property of z Transform.	**03**
	(b)	Find z Transform of $x[n] = na^n u[n]$.	**04**
	(c)	Determine inverse z Transform of $X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$ If (1) ROC : $\|z\| > 1$ (2) ROC : $\|z\| < 0.5$ (3) ROC: $0.5 < \|z\| < 1$	**07**

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