Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020
Subject Code:3141005   **Date:11/02/2021**
Subject Name:Signal & Systems
Time:02:30 PM TO 04:30 PM   **Total Marks:56**
Instructions:
    1. **Attempt any FOUR questions out of EIGHT questions.**
    2. **Make suitable assumptions wherever necessary.**
    3. **Figures to the right indicate full marks.**

                                          MARKS

Q.1	**(a)**	Find even and odd parts of $x(t) = u(t)$.	**03**
	(b)	Check whether the following system is dynamic, causal, time invariant, stable: $y[n] = \frac{1}{3}\{x[n] + x[n-1] + x[n-2]\}$	**04**
	(c)	Classify signals. Give examples of each.	**07**
Q.2	**(a)**	Sketch the following waveform: $x(t) = u(t+1) - 2u(t) - 2u(t-1)$.	**03**
	(b)	Define energy and power. Hence, define energy signal and power signal.	**04**
	(c)	Evaluate continuous time (CT) convolution integral given as: $$y(t) = e^{-2t}u(t) * u(t+2)$$	**07**
Q.3	**(a)**	List out properties of convolution.	**03**
	(b)	Find the step response of the system whose impulse response is given as: $h(t) = u(t+1) - u(t-1)$	**04**
	(c)	Find the exponential Fourier series of Half wave rectifies sine wave shown in figure:1.	**07**

Figure:1

Q.4	**(a)**	Find the output of an LTI system with impulse response $h(t) = \delta(t-3)$ for the input $x(t) = \cos 4t + \cos 7t$	**03**
	(b)	Calculate the convolution of $x[n]$ and $h[n]$: $x[n] = \{1,1,0,1,1\}$ $h[n] = \{1,-2,-3,4\}$	**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**
Q.5	**(a)**	State and prove frequency shifting property of Fourier Transform.	**03**
	(b)	Find the Fourier Transform of $x[n] = -a^n u[-n-1]$, where a is real.	**04**
	(c)	Compute DFT of the following sequence $x[n] = \{0,1,2,3\}$	**07**
Q.6	**(a)**	State and prove time scaling property of Fourier Transform.	**03**
	(b)	Bring out difference between DFT and Fourier Transform (FT).	**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**

Q.7 **(a)** Prove time shifting property of z- transform. **03**
(b) What is ROC with respect to z- transform? What are its properties? **04**
(c) Determine inverse z- transform of **07**

$$X(z) = \frac{1}{(1 + z^{-1})(1 - z^{-1})^2} \ , ROC: \ |z| > 1$$

Q.8 **(a)** Prove differentiation in z-domain property of z- transform. **03**
(b) Find the z- transform and ROC of the following sequence: **04**

$$x[n] = \frac{1}{2}\delta[n + 1] + 5\left(\frac{1}{2}\right)^{-n} u[n] + 4^n u[-n - 1]$$

(c) Determine the sequence $x[n]$ from following function: **07**

$$X(z) = \frac{1+z^{-1}}{1-z^{-1}+0.5z^{-2}} \text{ Assume that } x[n] \text{ is causal.}$$

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