Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV EXAMINATION – SUMMER 2020

Subject Code: 2141005 **Date:02/11/2020**

Subject Name: SIGNALS AND 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.**

			Marks
Q.1	**(a)**	Based upon nature and characteristics in the time domain, classify signals broadly. In each of the broad domains enlist signals further classification.	**03**
	(b)	Sketch each of the following signals. (i) x[n] = u[n] - u[n - 5] (ii) x(t) = u(t+4) . u(-t +4)	**04**
	(c)	Classify following systems as : Causal or non-causal; Linear or nonlinear and Time invariant or time variant $y(n) = \log_{10} \lvert x(n) \rvert$ $y(n) = n\,x(n) + x(n+2)$	**07**
Q.2	**(a)**	State and prove Linearity property of LTI systems using Laplace transform.	**03**
	(b)	For LTI system, if input sequence is $x(n)$ and impulse response is defined as h(n), derive equation for discrete time convolution sum y(n).	**04**
	(c)	Consider a causal LTI system with impulse response $h(t) = e^{-4t}u(t)$. Find the output of the system for an input $x(t) = 3.e^{-t}$	**07**
		OR	
	(c)	Solve the following difference equation $y(n) + 2y(n-1) = x(n)$ With $x(n) = (\frac{1}{3})^n u(n)$ and initial condition y(-1)=1	**07**
Q.3	**(a)**	Enlist dirichelts conditions for existence of Fourier transform.	**03**
	(b)	Find discrete time linear convolution of following two sequences using matrices method. $x(n) = 2\delta(n+1) - 3\delta(n) + \delta(n-1) + 2\delta(n-2)$ $h(n) = 2\delta(n-1) + 3\delta(n-2) + 4\delta(n-3)$	**04**
	(c)	Compute the Fourier transform for the signal x(t) in following Figure:01	**07**

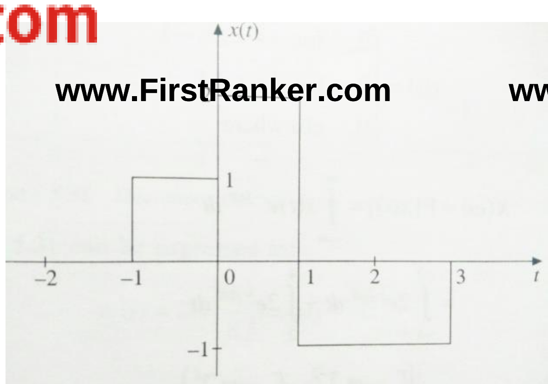

Figure:01

OR

Q.3 **(a)** Explain distributive property of LTI systems with suitable figures. **03**

(b) An LTI system has impulse response given by h(n)={2,1,2,1} . Find its response to input x(n)= {1,-2,4}. **04**

(c) Compute the Fourier transform for the signal x(t) in following Figure: 02. **07**

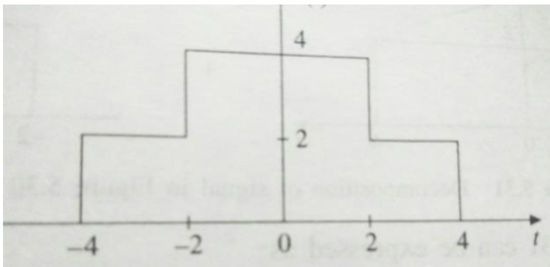

Figure:02

Q.4 **(a)** Prove that for causal sequences, the ROC of Z transform is exterior of a circle. **03**

(b) Find the Fourier transform of cosine wave $\cos w_0 t$. Draw its magnitude spectrum. **04**

(c) State and prove (a) Differentiation in time domain and (b) time shifting properties of LTI systems using Fourier transform. **07**

OR

Q.4 **(a)** Explain with suitable mathematical equations, relation between Laplace Transform and Fourier Transform, **03**

(b) Using properties of Z transform, compute Z transform for following signals. **04**

x(n)= u(-n)

x(n)= u(-n-2)

(c) Find fourier transforms of unit impluse function. Define clearly Signam function (sgn(t)) and with its help find FT of unit step function. **07**

Q.5 **(a)** Find inverse Z transform of **03**

$$X(z) = \frac{z^{-1}}{3 - 4z^{-1} + z^{-2}}; RoC|z| > 1$$

(b) Using Z transform, find the convolution of the sequences $x_1(n) = \{1,2,3,4\}; x_2(n) = \{1,1,1\}$ **04**

(c) Determine steady state (forced) response for the system with impulse response $h(n) = (\frac{1}{2})^n u(n)$ for the input $x(n) = [\cos(\pi n)]u(n)$. **07**

OR

Q.5 **(a)** Find inverse Z transform of **03**

$$X(z) = 2z^{3} + z^{2} + z + 3 - 2z^{-1} + 4z^{-2} - z^{-3}$$

(b) Write the properties of ROC of X(z). **04**

(c) An LTI system is described by the difference equation **07**

$$y(n) - \frac{9}{4}y(n-1) + \frac{1}{2}y(n-2) = x(n) - 3x(n-1)$$

Specify the ROC of H(z) and determine h(n) for the following conditions,

(i) The system is stable

(ii) The system is causal