Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 3131705 **Date: 28/11/2019**

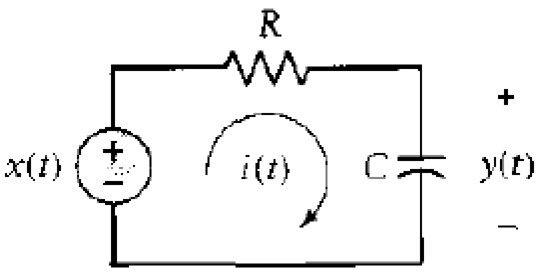
Subject Name: Dynamics of Linear Systems

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

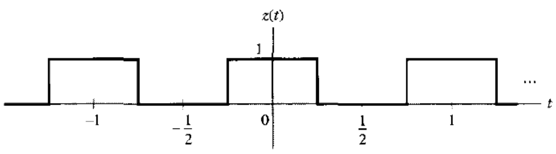
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	(i) Define system. (ii) List out the types of system.	**03**
	(b)	Explain convolution property of z-transform.	**04**
	(c)	Consider the RC circuit given in the figure below. Assume that the circuit's time constant is RC = 1 s. The impulse response of this circuit is given by h(t) = $e^{-t}u(t)$. Determine the voltage across the capacitor, y(t), resulting from an input voltage x(t) = u(t) – u(t-2).	**07**



Q.2	**(a)**	Use the convolution property to find the FT of the system output Y(jω) for the following inputs and system impulse response: $x(t) = 3e^{-t}u(t)\ and\ h(t) = 2e^{-2t}u(t)$	**03**
	(b)	Use the convolution property to find the time-domain signal corresponding to the following frequency-domain representation: $X(e^{j\Omega}) = \left(\frac{1}{1-\left(\frac{1}{2}\right)e^{-j\Omega}}\right)\left(\frac{1}{1+\left(\frac{1}{2}\right)e^{-j\Omega}}\right)$	**04**
	(c)	Evaluate the periodic convolution of the sinusoidal signal $z(t) = 2\cos(2\pi t) + \sin(4\pi t)$ with the periodic square wave x(t) as shown below:	**07**



OR

	(c)	The output of an LTI system in response to an input $x(t) = e^{-2t}u(t)$ is $y(t) = e^{-t}u(t)$. Find the frequency response and the impulse response of this system.	**07**
Q.3	**(a)**	Find the DTFT of x[n] = δ[n]	**03**

(b) Determine the Fourier Series coefficients for the signal defined by **04**

$$x(t) = \sum_{t=-\infty}^{\infty} \delta(t-4l)$$

(c) Prove the following properties in context of Continuous Time Fourier Transform: **07**
(i) Time shifting
(ii) Time and frequency scaling

OR

Q.3 **(a)** State Dirichlet condition for Fourier series representation. **03**
(b) Prove the duality property of Fourier transform. **04**
(c) Determine the appropriate Fourier representations of the following time domain signals: **07**
(i) $x(t) = e^{-t}\cos(2\pi t)u(t)$
(ii) $x(t) = |\sin(2\pi t)|$

Q.4 **(a)** Explain the linearity property of Laplace transform. **03**
(b) Derive the relationship between Laplace transform and Fourier transform. **04**
(c) Analyze the role of Region of Convergence (ROC) for defining the stability of system in the context of Laplace transform. **07**

OR

Q.4 **(a)** Explain the modulation property in context of Fourier transform. **03**
(b) Explain the differencing and summation property of discrete Fourier transform. **04**
(c) Find the inverse Discrete Time Fourier Transform (DTFT) of **07**

$$X(e^{j\Omega}) = \frac{-\frac{5}{6}e^{-j\Omega} + 5}{1 + \frac{1}{6}e^{-j\Omega} - \frac{1}{6}e^{-j\Omega 2}}$$

Q.5 **(a)** Explain the linearity property of z-transform. **03**
(b) Explain the concept of poles and zeros with respect to z-transform. **04**
(c) Determine the z-transform of the signal **07**

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

Depict the ROC and the locations of poles and zeros of X(z) in the z-plane.

OR

Q.5 **(a)** Explain the initial value theorem in conext of z-transform. **03**
(b) Determine the z-transform of the signal **04**

$$x[n] = \alpha^n u[n]$$

(c) Find the inverse z-transform of **07**

$$X(z) = \frac{2 + z^{-1}}{1 - \frac{1}{2}z^{-1}}$$

with ROC $|z| > \frac{1}{2}$

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