Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) • EXAMINATION – WINTER 2016

Subject Code:2141005 **Date:25/11/2016**

Subject Name:Signals and 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 **Choose a correct answer.** **14**

1 Random signal can be modeled by (a) differential equation (b) difference equation (c) statistical equation (d) integral

2 Periodic signals are (a) x(t+T)= x(t) (b) x(t-T)= x(T) © x(n+mN)= x[n] (d) all the above

3 Even signal satisfies (a) x(-t)=x(t) (b) x[-n]=-x[n] © x(n+1)=ax[n]+b (d) any of the above

4 Which system is non-casual system (a) y(t)= x(t+1) (b) y(t)=x(t-1) (c) y(t)=x(t)+c (d) y(t)= x(t-1)+c

5 Which signal is non causal (a) x(t)=0 t<0 (b) x(t)=0 t>0 © x(n)=0 n<0 (d) x(t)=1 t>0

6 In memory less system (a) zero state response is zero (b) zero input response is zero (c) both responses are zero (d) both responses are finite

7 Laplace transform of u(t) is
(a) 1/s (b) s (c)1 (d) s^2

8 Inverse Laplace transform of $\frac{1}{(s+a)^2}$ is
(a) tu(t) (b) te^{-at} u(t) (c) e^{-at} u(t) (d) ae^{-at} u(t)

9 Inverse Laplase Transform of $\frac{10}{s^2+2s+5}$
(a) $5e^{-t}$ sin2t (b) $5e^{-t}$ cos2t (c) $5e^{t}$ sin2t (d) $5e^{t}$ cos2t

10 For causal signal x[n], z transform X[z] is
(a) X(z)= $\sum_{n=-\infty}^{\infty} x[n]z^{-n}$ (b) X(z)= $\sum_{n=0}^{\infty} x[n]z^{-n}$
(c) X(z)= $\sum_{n=-\infty}^{\infty} x[n]z^{n}$ (d) X(z)= $\sum_{n=0}^{\infty} x[n]z^{n}$

11 z-transform of $\delta(n)$ is (a) 1 (b) 0 (c) -1 (d) all of the above

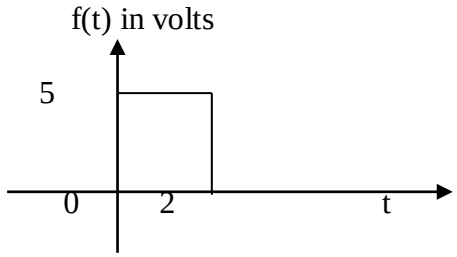
12 z-transform of $x[n-n_0]$ is (a) $z^{-n_0} X(z)$ (b) $z^{n_0} X(z)$
© $X(z+z_0)$ (d) all of the above

13 Signal x(t) is odd signal if (a) x(t) = -x(t) (b) x(t) = - x(-t)
© x(t+T) (d) x(t-T)

14 Fourier transform of $\delta(t)$
(a) zero (b) 1 (c) 2π (d) None of the above

Q.2	**(a)**	Explain classification of signals.	**03**
	(b)	Explain classification of systems.	**04**
	(c)	A system has the input-output relation given by $y[n]=T(x[n])=nx[n]$ determine whether the system is (i) memory less (ii) causal (iii) linear (iv) time-invariant (v) stable	**07**
		OR	
	(c)	Explain the property of continuous time and discrete time Systems.	**07**
Q.3	**(a)**	Consider the system described by $Y'(t) + 2\,y(t) = x(t) + x'(t)$ Find the impulse response h(t) of the system.	**03**
	(b)	Explain sampling and quantization.	**04**
	(c)	Define Z-transform. Explain region of convergence.	**07**
		OR	
Q.3	**(a)**	Define convolution and explain initial value and final value theorem.	**03**
	(b)	Determine the inverse Z-transform of the following X(z) by the partial fraction expansion method. $X(z)=\dfrac{Z+1}{2Z^2-7Z+3}$	**04**
	(c)	Define Laplace transform. Prove linearity property of Laplace transform. State how ROC of Laplace transform is useful for in defining stability of system.	**07**
Q.4	**(a)**	Explain the trigonometric fourier series.	**03**
	(b)	Define Fourier transform and explain any two property of it.	**04**
	(c)	Find the Z-transform of the following signals. (a) $x(n) = \delta(n-n_0)$ (b) $x(n)= a^{n+1}u(n+1)$ (c) $x(n)= a^{-n}u(-n)$	**07**
		OR	
Q.4	**(a)**	Find the fourier transform of the signal $x(t) = \dfrac{1}{a^2+t^2}$	**03**
	(b)	Find the inverse z-transform of $X(z) = z^2(1-\frac{1}{2}z^{-1})$	**04**
	(c)	Find the Fourier transform of f(t). $f(t)= e^{-at}\cos(bt)$	**07**

Q.5 **(a)** Find Fourier transform of a rectangular pulse 2 seconds with a magnitude of 5 Volts as shown in below figure. **03**



(b) Derive the relationship between Laplace Transform and Fourier Transform. **04**

(c) Determine whether or not each of the following signals is periodic? If the signal is periodic, find the fundamental time period. **07**

(a) $x(t) = \left[\sin(2t - \frac{\pi}{3})\right]^2$

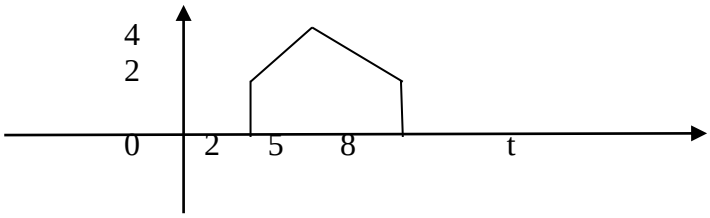
(b) $x(n) = \cos(n\pi/8)$

OR

Q.5 **(a)** Define discrete fourier transform and explain important Features of it. **03**

(b) Explain the properties of Region of Convergence with reference to z-transform. **04**

(c) Derive the Convolution integral for CTS. Find out the even and odd part of the following signal **07**



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