GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) - EXAMINATION - SUMMER 2017

Subject Code: 2141005

Subject Name: Signals and Systems

Time: 10:30 AM to 01:00 PM

Instructions:

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

Q.1 Short Questions (One mark each)

- **1** Differentiate between Continuous time and Discrete time signals.
- 2 State the condition for a discrete time sinusoidal signal to be periodic.
- **3** Define: Impulse response.
- 4 Define: Aliasing.
- 5 If X(s) is Laplace transform of signal x(t), find Laplace transform of x(t-T).
- 6 Fill in the blank: $x(n)\delta(n-k) =$ _____.
- 7 Justify: "Static systems are causal but all causal systems are not static."
- 8 If z-Transform of signal x(n) has ROC $R_1 < |z| < R_2$, find ROC of signal x(-n).
- **9** Find z-Transform of signal $x(n) = \delta(n+1) \delta(n-1)$.
- 10 x(n) and h(n) are finite length discrete time signals with length of 32 and 21 respectively. If y(n) is convolution of x(n) and h(n), find length of y(n).
- **11** Select appropriate: Trigonometric Fourier series representation of a periodic odd signal will contain _____ (cosine/sine/dc) term.
- 12 Fill in the blank: If x(t) is a real signal and $X(\omega)$ is its Fourier transform then $X^*(\omega) =$ ______. (* represents conjugate)
- 13 Give Parseval's relation for Fourier transform.

State and prove Sampling Theorem.

(c)

14 Justify: "If X(z) is rational then ROC of X(z) does not contain any poles."

Q.2	(a) (b)	Determine whether signal $x(n) = e^{j4n}$ is energy signal or power signal. Continuous time signals $x_1(t)$ and $x_2(t)$ are periodic with period T_1 and T_2 respectively. Signal $x_3(t)$ is defined as $x_3(t)=x_1(t) + x_2(t)$. Find condition for $x_3(t)$ to be periodic.	03 04
	(c)	Sketch signal $x(t) = u(t+2) - u(t-2) + u(t+1) - u(t-1)$. Also sketch i) $x(2t)$ ii) $x(1-t)$ iii) $x(t)u(t)$.	07

OR

07

03

- **Q.3** (a) Evaluate the convolution $x(n) * \delta(n-n_0)$.
 - (b) For LTI system derive the condition on impulse response h(n) for system to be **04** stable.

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Date: 14/06/2017

Total Marks: 70

(c) Determine if given system is - linear, time-invariant, causal, stable and static. 07 Justify your answer.

$$y(n) = n x(-n)$$

Here y(n) represents system output and x(n) represents system input.

- Q.3 (a) Prove that convolution is a commutative operation.
 - (b) Identify if the system y(t) = Ax(t) + B is linear. Justify your answer. Here y(t) is 04 system output, x(t) is system input and A&B are constants.

(c) Compute convolution for the following

- i) $x(n) = (1/5)^n u(n), \quad h(n) = (1/2)^n u(n)$
- ii) x(t) = u(t), $h(t) = e^{-t}u(t)$

Q.4 (a) State Dirichlet condition for Fourier series representation. 03

- (b) Give relation between Fourier transform and Laplace transform. 04
- (c) Consider periodic signal x(t) as shown below, determine its complex 07 exponential Fourier series representation.



OR

Q.4 (a) Prove time shifting property of Fourier transform.

- (b) Plot magnitude and phase of complex exponential Fourier series coefficients 04 of signal $x(t) = 1 + sin\omega_0 t$.
- (c) Obtain Fourier transform of signal $x(t) = e^{-a/t/t}$ for all *t*. 07
- **Q.5** (a) Compute DFT of the sequence $x(n) = \{0, 1, 2, 3\}$. 03
 - (b) If signal x(n) has z-Transform $X(z) = \frac{z^2}{z^2 16} |z| < 4$, using properties find z-Transform of signal $2^{-n}x(n)$.
 - (c) Determine inverse z-Transform of following using partial fraction method. 07 Given that ROC of X(z) includes unit circle.

$$X(z) = \frac{3}{1 - \frac{10}{3}z^{-1} + z^{-2}}$$

OR

- Q.5 (a) Evaluate Fourier transform of $\delta(t)$. Using duality property find Fourier 03 transform of signal x(t) = 1 for all t.
 - (b) Prove differentiation property of z-Transform. 04
 - (c) Determine z-Transform of following signals. 07

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