Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2141005 **Date: 14/06/2017**

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.**

Q.1 **Short Questions (One mark each)** **14**

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.

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

Q.2 **(a)** Determine whether signal $x(n) = e^{j4n}$ is energy signal or power signal. **03**

(b) 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. **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

(c) State and prove Sampling Theorem. **07**

Q.3 **(a)** Evaluate the convolution $x(n)*\delta(n-n_0)$. **03**

(b) For LTI system derive the condition on impulse response $h(n)$ for system to be stable. **04**

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

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

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

OR

Q.3 **(a)** Prove that convolution is a commutative operation. **03**

(b) Identify if the system $y(t) = Ax(t) + B$ is linear. Justify your answer. Here $y(t)$ is system output, $x(t)$ is system input and A&B are constants. **04**

(c) Compute convolution for the following **07**

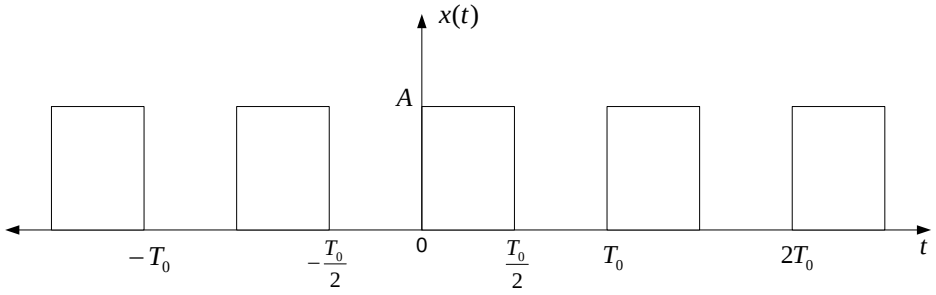
i) $x(n) = (1/5)^n u(n),\quad h(n) = (1/2)^n u(n)$

ii) $x(t) = u(t),\quad h(t) = e^{-t}u(t)$

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 exponential Fourier series representation. **07**



OR

Q.4 **(a)** Prove time shifting property of Fourier transform. **03**

(b) Plot magnitude and phase of complex exponential Fourier series coefficients of signal $x(t) = 1 + \sin\omega_0 t$. **04**

(c) Obtain Fourier transform of signal $x(t) = e^{-a|t|}$ 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 $2^{-n}x(n)$. **04**

(c) Determine inverse z-Transform of following using partial fraction method. Given that ROC of $X(z)$ includes unit circle. **07**

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

OR

Q.5 **(a)** Evaluate Fourier transform of $\delta(t)$. Using duality property find Fourier transform of signal $x(t) = 1$ for all t. **03**

(b) Prove differentiation property of z-Transform. **04**

(c) Determine z-Transform of following signals. **07**

i) $x(n) = 2^n u(-n)$

ii) $x(n) = \frac{1}{4^n}u(n-1)$

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