

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2018

Subject Code:2141005

Date:14/12/2018

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**
- (a) Explain Energy and power signal **03**
- (b) Explain time shifting and periodicity property of laplace transform. **04**
- (c) Write the properties of convolution and explain them with suitable example. **07**

- Q.2**
- (a) Define system and explain the classification of system. **03**
- (b) Consider the following signal **04**
- $X(t) = Ae^{\alpha t}u(t)$, $\alpha > 0$
- Is $X(t)$ an energy signal or power signal as $\alpha \rightarrow 0$ what is the nature of signal?
- (c) Compute convolution: **07**

1.) $y(n) = x(n) * h(n)$, $x(n) = \{1, 1, 0, 1, 1\}$,

↑

$h(n) = \{1, -2, -3, 4\}$

↑

2.) $y(n) = x(n) * h(n)$, $x(n) = h(n) = \{1, 2, -1, 3\}$

↑

OR

- (c) Explain the properties of continuous time and discrete time systems. **07**
- Q.3**
- (a) Prove that a DT LTI system is causal if and only if $h(n) = 0$ for $n < 0$. **03**
- (b) Impulse response of DT LTI system is given by $h(n) = n \left(\frac{1}{2}\right)^n u(n)$. **04**
- Determine whether the system is stable or not.
- (c) Obtain the convolution integral of **07**
- $X(t) = 1$ for $-1 \leq t \leq 1$
- $H(t) = 1$ for $0 \leq t \leq 2$

OR

- Q.3**
- (a) State and prove a condition for a discrete time LTI system to be stable. **03**
- (b) Find and sketch even and odd component of following: **04**
- $$f(x) = \begin{cases} t, & 0 \leq t \leq 1 \\ 2 - t, & 1 \leq t \leq 2 \end{cases}$$
- (c) Find the convolution of two signals $X_1(t)$ and $X_2(t)$ **07**
- $X_1(t) = e^{-4t}u(t)$
- $X_2(t) = u(t - 4)$

- Q.4**
- (a) State and prove the initial value theorem. **03**

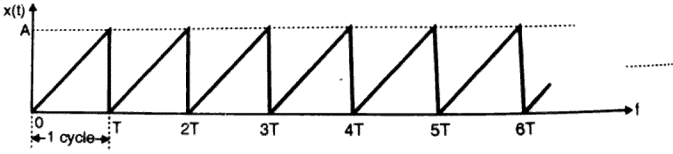
- (b)

Prove the duality or symmetry property of fourier transform.

04
- (c)

Find the fourier series representation for the saw tooth wave depicted in the following figure.

07



OR

- Q.4

(a)

Write the time scaling property of fourier transform and find the fourier transform of $x(t)=e^{-\alpha t}u(t)$

03
- (b)

Prove that when a periodic signal is time shifted, then the magnitude of its fourier series coefficient remains unchanged. ($|a_n|=|b_n|$)

04
- (c)

Find the fourier transform of the periodic signal $x(t)=\cos(2\pi ft) u(t)$

07
- Q.5

(a)

Obtain the DFT of unit impulse $\delta(n)$

03
- (b)

Determine the z-transform of following finite duration sequence $X(n)=\{1,2,4,5,0,7\}$

04
- (c)

Find the Z-transform of the signal

07

↑

$$X(n)=\left(-\frac{1}{5}\right)^n u(n)+5\left(\frac{1}{2}\right)^n u(-n-1)$$

OR

- Q.5

(a)

Explain discrete fourier transform and enlist its features.

03
- (b)

Define the region of convergence with respect to z-transform.

04
- (c)

Find the inverse z-transform of

07

$$X(z)=\frac{z}{z-1} \quad |z| > 1$$
