Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Winter 2022 - 23 Examination

Semester: 3 **Date: 03/10/2022**
Subject Code: 203106201 **Time: 02:00 pm to 04:30 pm**
Subject Name: Fundamentals of Signals and Systems **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 **Objective Type Questions** - (Fill in the blanks, one word answer, MCQ-not more than Five in case of MCQ) (All are compulsory) (Each of one mark) **(15)**

1. The Laplace Transform of the signal $x(t)=\delta(t)$ is _____.
2. For the given function $H(s)=\dfrac{(s-1)}{(s+1)(s+4)}$, the system poles are _____.
3. Consider the system $y[n]=2x[n]+5$. Is the function linear (True/False)?
4. A system which is linear is said to obey the rule(s) of _____.
5. $\int_{-\infty}^{1}\delta(\tau)d\tau$ is

i) $\delta(t)$ ii) $u(t)$ iii) $r(t)$ iv) None of the above

6. If $x(t)\leftrightarrow X(\omega)$. Then, $x(-t)$ will have Fourier transform _____.
7. The derivative of unit step function is called _____ function.
8. The area under an impulse function is _____.
9. What is the full form of BIBO?
10. The z transform of $x(-n)$ is _____.

i) $X(z)$ ii) $X(-z)$ iii) $X\left(\dfrac{1}{z}\right)$ iv) $X\left(-\dfrac{1}{z}\right)$

11. If $x(t)\leftrightarrow X(\omega)$. Then, $x(t-t_o)$ will have Fourier transform _____.
12. Is the above system, i.e. $y[n]=x^2[n-2]$ time invariant (True/False)?
13. A continuous time system $y(t)=x(2t)$ is _____.

i) linear, causal and time variant ii) nonlinear, non-causal and time invariant
iii) nonlinear, causal and time variant iv) linear, non-causal and time variant

14. If $x_1[n]\leftrightarrow X_1[z]$ and $x_2[n]\leftrightarrow X_2[z]$. Then, $x_1[n]\otimes x_2[n]$ will be _____.
15. The z- transform of $\delta(n+3)$ is _____ .

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Solve the second order differential equation $y''(t)+5y'(t)+6y(t)=x(t)$ with the initial conditions $y(0)=2$, $y'(0)=1$, and $x(t)=e^{-t}u(t)$.

B) Find the Laplace transform $X(s)$ for $x(t)=e^{2t}u(t)+e^{-3t}u(-t)$.

C) Find the z transform of unit step sequence $u[n]$.

D) Define: i) even and odd signals ii) step and ramp signals iii) continuous and discrete signals iv) periodic and non-periodic signals v) deterministic and random signals

Q.3 A) For a continuous time system defined as $y(t)=x(-t)$. Check, if the system is linear, dynamic, time variant and causal. **(07)**

B) The input $x(t)$ and the impulse response $h(t)$ of a continuous time LTI system are given by **(08)**

$x(t)=u(t)$ and $h(t)=e^{-\alpha t}u(t);\alpha>0$. Compute the output $y(t)$ with the help of convolution.

OR

B) Find $X(z)$ and its ROC for a finite sequence $x(n)=\left\{5,2,-1,0,\underset{\uparrow}{-2},-3\right\}$. **(08)**

Q.4 A) The output $y[n]$ of a discrete time LTI system is found to be $2\left(\frac{1}{3}\right)^n u[n]$ when the input $x[n]$ is $u[n]$. Find the system function $H[z]$. **(07)**

OR

A) The output $y(t)$ of a continuous time LTI system is found to be $2e^{-3t}u(t)$ when the input $x(t)$ is $u(t)$. Find the system function $H[s]$ **(07)**

B) i) Explain Nyquist sampling theorem. What are the effects of under sampling? **(08)**

ii) Consider a continuous time exponential signal $x(t)=e^{-at}u(t);\ a>0$. Find its Fourier transform.