Paper id: 252566

Roll No: _____

BTECH
(SEM IV) THEORY EXAMINATION 2024-25
SIGNAL SYSTEM

TIME: 3 HRS   **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. **Attempt *all* questions in brief.**   **02 x 7 = 14**

Q no.	Question	CO	Level
a.	Define energy and power signals with examples.	1	K1
b.	State and explain the properties of linear systems.	1	K2
c.	What is convolution? Write its significance in LTI systems.	2	K2
d.	Compare the Fourier series and the Fourier Transform.	3	K4
e.	Define Region of Convergence (ROC) in Z-transform.	4	K1
f.	Explain aliasing in the context of sampling.	5	K2
g.	What are eigenfunctions of LSI systems?	3	K2

SECTION B

2. **Attempt any *three* of the following:**   **07 x 3 = 21**

Q no.	Question	CO	Level
a.	Define even and odd signal. Determine the even and odd components of the signal: $x(t) = cos(t) + sin(t) + cos(t) \cdot sin(t)$	1	K3
b.	An LTI system is described by differential equation: $\frac{dy(t)}{dt} + 2y(t) = x(t)$ Find the impulse response of the system.	2	K4
c.	Using Fourier transform, find the convolution of the following signals $x_1(t) = e^{-4t} u(t), \ x_2(t) = e^{-8t} u(t)$	3	K3
d.	State and prove the time-shifting and frequency-shifting properties of the Z-transform. Illustrate each property with an example.	4	K5
e.	Explain the reconstruction of a signal from its samples using Interpolation.	5	K2

SECTION C

3. **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level

a.	Test the system defined by $y(t) = t \cdot x(t)$ for the following properties:
	   i. Linearity
	   ii. Time-invariance
	   iii. Causality
		2	K4

b.	A signal $x(t) = e^{-5t}u(t)$ is given. Determine whether it is an energy or a power signal, and determine its energy and power.	2	K3

Paper id: 252566

Roll No:

BTECH
(SEM IV) THEORY EXAMINATION 2024-25
SIGNAL SYSTEM

TIME: 3 HRS   **M.MARKS: 70**

4.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Compute the Convolution integral on the signals $x(t) = e^{-3t} u(t)$ and $h(t) = u(t)$.	3	K3
b.	A system has an impulse response given by $h(t) = e^{-6t}u(t)$ 1. Determine the step response *s(t)* of the system. 2. Check whether the system is BIBO stable and causal or not.	3	K4

5.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Find the inverse Laplace of the following: $X(S) = \frac{2}{(S+4)(s-1)}$; if the region of convergence is $-4 < \text{Re}\{s\} < 1$	3	K4
b.	Analyze the Discrete Time Fourier Transform of the following: $x(n) = 0.5^n u(n) + 2^{-n} u(-n-1)$	3	K5

6.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Determine the Z transform of $x(n) = sin(\omega_0 n) u(n)$ and sketch the ROC.	4	K4
b.	Determine the inverse Z transform of the following function $H(z) = \frac{0.2z}{(z + 0.4)(z - 0.2)};\ ROC : |z| > 0.4$	4	K5

7.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	State and prove the Sampling theorem and discuss the effect of under-sampling.	5	K4
b.	A continuous-time signal x(t)=cos(500πt)+sin(700πt) is sampled at a rate of 400 Hz. i. Determine whether aliasing will occur. ii. Justify your answer using the Nyquist criterion. iii. If aliasing occurs, compute the aliased frequency.	5	K3