Roll No: ☐☐☐☐☐☐☐☐☐☐☐☐☐

BTECH
(SEM IV) THEORY EXAMINATION 2023-24
SIGNAL SYSTEM

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

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt all questions in brief.**   2 x 7 = 14

a.	Determine the fundamental period of the signal $x(t) = \sin(4t-1)$.	2
b.	Write the general formula for calculating Convolution in Continuous Time Domain.	2
c.	Find the Fourier Transform of continuous time signal $x(t) = \delta(t + 1)$.	2
d.	Calculate the Z-Transform of discrete time signal $x(n) = \delta(n + 1)$.	2
e.	Sketch the Sampled Signal of $x(t) = \cos(2\pi t)$.	2
f.	Sketch the continuous time signal $x(t) = u(-t+1)$.	2
g.	What is Parseval's Theorem?	2

SECTION B

2. **Attempt any three of the following:**   7 x 3 = 21

a.	Define the following terms related to system with mathematical expressions (i) Linear System (ii) Stability (iii) Causality and (iv) Dynamic system.	7
b.	A causal LTI system is described by difference equation. $$y(n) = y(n-1) + y(n-2) + x(n-1)$$ Find the system function $H(z) = Y(z)/X(z)$ for this system. Plot the pole-zero plot of $H(z)$ and indicate the region of convergence.	7
c.	Sketch the signal $y(t) = e^{-t}u(t)$ & find the Fourier Transform of this same signal with Magnitude & Phase Curve.	7
d.	What is ROC? Discuss any three properties of Z-Transform with mathematical expressions and example.	7
e.	Describe Natural Sampling process with graphs and mathematical equations.	7

SECTION C

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

a.	Define Time Invariant system. Also check whether the given system is Time Variant or Invariant system (i) $y_1(t) = tx(t)$, (ii) $y_2(n) = 2x(n)+3$, (iii) $y_3(t) = 2x(-t)$.	7
b.	Define the following with mathematical expressions and examples (i) Energy & Power Signals, (ii) Even & odd Signals.	7

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

a.	What is Discrete Time Convolution? Find the convolution $y(n) = x(n)*h(n)$ of the discrete time signals $x(n) = h(n) = u(n)$.	7
b.	What is LTI System? An LTI system is described by differential equation $\frac{dy(t)}{dt}+5y(t)=3x(t)$. Calculate (i) Transfer Function, $H(s) = Y(s)/X(s)$. (ii) Output, $y(t)$ when $x(t) = u(t)$.	7

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5.	Attempt any *one* part of the following:	7 x 1 = 7
a.	Write any three properties of Fourier Transform. Find the Fourier Transform of the given signal using Properties $y(t)=te^{-4t}u(t)$.	7
b.	Determine the Inverse Laplace transform of the following functions using Partial Fraction method: (i) $X(s) = \frac{4(s+3)}{s(s+1)(s+2)}$ (ii) $Y(s) = \frac{4}{(s+1)(s+2)^2}$	7

6.	Attempt any *one* part of the following:	7 x 1 = 7
a.	Determine the Inverse Z-Transform y(n) of the following functions $Y(z) = \frac{z^2}{(z^2+3z+2)}$, given **ROC |z|>2**. https://www.aktuonline.com	7
b.	Determine the z-transform of $x(n) = (1/2)^n u(n)$ and depict the ROC and the location of poles and zeros in the z plane.	7

7.	Attempt any *one* part of the following:	7 x 1 = 7
a.	Explain Ideal Sampling with time domain & frequency domain graphs and mathematical equations.	7
b.	What is Nyquist Rate & Nyquist Interval? Calculate the Nyquist rate & Nyquist Interval for the following continuous-time sinusoidal signals (i) $x_1(t)=\cos(20\pi t)+\cos(40\pi t)$. and (ii) $x_2(t)=\cos(200\pi t)\cos(400\pi t)$.	7