BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO-2024)

CLASS: BTECH. **SEMESTER: VII**
BRANCH: CSE **SESSION: MO/2024**

SUBJECT: EC437R1 INTRODUCTION TO SIGNAL PROCESSING

TIME: 3 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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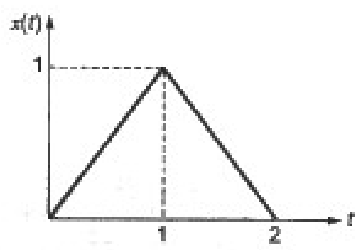
			CO	BL
Q.1(a)	Sketch the following signal $x(t) = e^{-a\|t\|}$ for $a > 0$. Also determine whether the signal is a power signal or an energy signal or neither.	[4]	CO1	VI
Q.1(b)	Test the given system for following properties: $y(n) = x(n).u(n)$ (i) Linearity (ii) Causality (iii) Time Invariance	[6]	CO1	II
Q.2(a)	State and prove Differentiation, Integration and Convolution property of Fourier transform	[6]	CO2	I
Q.2(b)	Find the Laplace transform of the pulse $x(t)$ given below	[4]	CO2	VI



Q.3(a)	Find the 4-point DFT of $x(n) = \begin{cases} \frac{1}{3}; 0 \le n \le 2 \\ 0; else\ where \end{cases}$ and Plot its phase pattern	[4]	CO3	VI
Q.3(b)	Determine the Z-transform and their region of convergence for the following discrete time signals: (i) $x(n) = \left[3\left(\frac{4}{5}\right)^n - \left(\frac{2}{3}\right)^{2n}\right].u(n)$ (ii) $x(n) = 2^n u(n) - 3^n u(-n)$	[6]	CO3	III
Q.4(a)	An FIR filter is characterized by the following transfer function $H(z) = \sum_{n=0}^{M-1} h(n) z^{-n}$ Determine the magnitude response and prove that the phase response and group delays are constant.	[4]	CO4	III
Q.4(b)	Obtain direct form-I and II realization of a system described by: $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$	[6]	CO5	VI
Q.5(a)	A random variable X has the density function $(x) = \frac{c}{x^2+1}$, where $-\infty < x < \infty$. Find the value of the constant c. Find the probability that X^2 lies between 1/3 and 1.	[5]	CO5	VI
Q.5(b)	Consider a random process $X(t) = A\cos(\omega_0 t + \theta)$, where ω_0 and A are constant. θ is uniformly distributed in $[0, \pi]$. Check whether the random process is wide sense stationary or not.	[5]	CO5	IV

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