**Roll No:** | | | | | | | | | | | |

# PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
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Bengaluru

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

**Mid Term Examinations - October 2026**

**Date:** 09/10/2026 **Time:** 11:45 AM - 01:15 PM

**Course Code:** ECE2500 **Course Name:** Signals and Systems

**Semester:** Third Semester **Max. Marks:** 50 **Weightage:** 50%

| CO - Levels | CO1 | CO2 | CO3 | CO4 |
|---|---|---|---|---|
| Marks | 24 | 22 | 22 | 22 |

**PART A: Answer Following Questions. 10 M**

| Q.N. | Questions | M | CO | BT |
|---|---|---|---|---|
| 1 | Signals can be represented as functions of time, space, or other independent variables. Define the continuous-time unit ramp signal $r(t)$ and sketch its waveform. | 2 | CO1 | BT1 |
| 2 | Signals and Systems form the foundation of communication, control, and signal processing engineering. A signal is defined as $x(t) = 2u(t) - u(t-2)$. Sketch the signal $x(t)$ and indicate its amplitude levels and transition points. | 2 | CO1 | BT2 |
| 3 | Additivity and scaling are the two properties of linear systems. A system is described by $y(n) = n^2 x(n)$. Determine whether the system is linear or nonlinear, giving a suitable reason. | 2 | CO2 | BT3 |
| 4 | Convolution is a mathematical operation used to determine system output. State any two properties of convolution. | 2 | CO3 | BT1 |
| 5 | Fourier transform converts a time-domain signal into the frequency domain. Define inverse Fourier Transform. | 2 | CO4 | BT1 |

**PART B : Answer Any 1 Following Questions. 10 M**

| Q.N. | Questions | M | CO | BT |
|---|---|---|---|---|
| 6 | a. The impulse signal is used to characterize many systems. A continuous-time signal is given by $x(t) = 2u(t) + 2sin2t$. Determine whether the signal is periodic or non-periodic and find its fundamental period.<br>b. The amplitude of a signal indicates its strength or magnitude. For a given signal $x(n) = \{-2, 1, 2, -1, 3\}$, determine the even component $x_e(n)$ and odd component $x_o(n)$ of the signal. Verify that $x(n) = x_e(t) + x_o(t)$. | 10 | CO1 | BT3 |
| 7 | The unit step signal is widely used in system analysis. Consider the continuous-time signal, $x(t) = \cos t$<br>a. Determine the energy of the signal.<br>b. Determine the average power of the signal.<br>c. Classify the signal as an energy signal or power signal, giving justification. | 10 | CO1 | BT3 |

**PART C: Answer Any 1 Following Questions. 10 M**

| Q.N. | Questions | M | CO | BT |
|---|---|---|---|---|

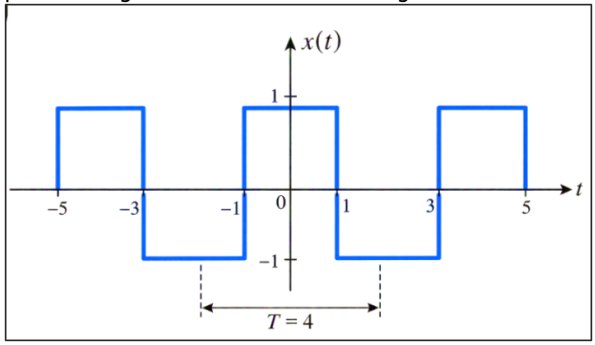

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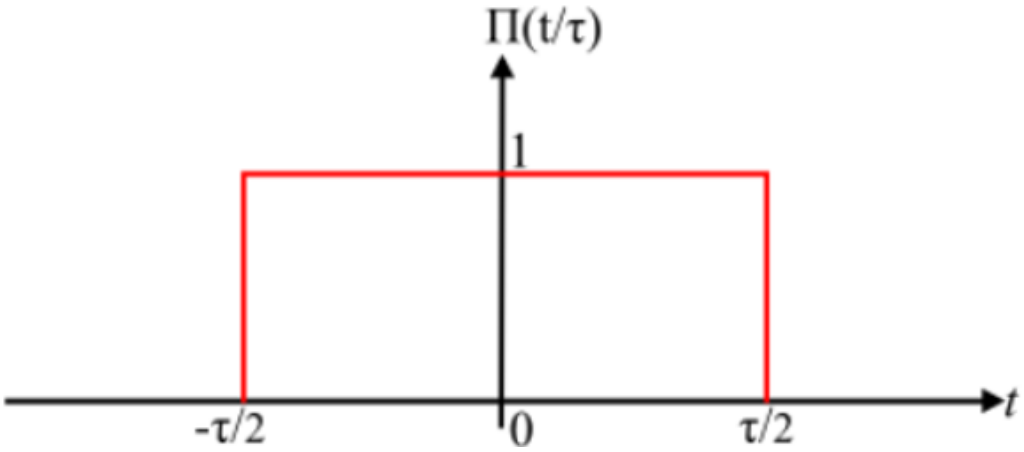
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|---|---|---|---|---|
| 8 | Dynamic systems depend on past or future input values. Consider the system described by $y(t) = 10\,x(t) + 4.$ Analyze the given system with respect to the following properties:<br>**a.** Linearity<br>**b.** Time invariance<br>**c.** Causality<br>**d.** Stability<br>Justify your analysis with appropriate mathematical expressions. | 10 | CO2 | BT4 |
| 9 | Digital signal processing improves the quality of audio recordings. Consider the discrete time system described by $y(n) = n^2\,x(n).$. Analyze the given system with respect to the following properties:<br>**a.** Linearity<br>**b.** Time invariance<br>**c.** Causality<br>**d.** Stability<br>Justify your analysis with appropriate mathematical expressions. | 10 | CO2 | BT4 |

**PART D: Answer Any 1 Following Questions. 10 M**

| Q.N. | Questions | M | CO | BT |
|---|---|---|---|---|
| 10 | Speech recognition systems rely on signal analysis to identify spoken words. Linear Time-Invariant (LTI) systems are fundamental in signal analysis due to their predictable behavior. An LTI causal system is specified by the equation, $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) + 4x(t).$. The input is $x(t) = e^{-t}u(t)$. Apply the method of solving linear differential equations to determine:<br>a. Natural response (zero-input response) for initial condition, $y(0) = 3$, $\frac{dy(0)}{dt} = 0$<br>b. Forced response<br>c. Total response | 10 | CO3 | BT3 |
| 11 | Biomedical signal processing helps doctors diagnose diseases. Apply the concept of convolution of two sequences, determine the output response $y(n)$, if $x(n) = \{1, 2, 2, 2\}$ and $h(n) = \{1, 2, 2\}$ using the graphical convolution method. Clearly show the shifting, folding, and overlap regions. Sketch the resulting output signal $y(n)$. | 10 | CO3 | BT3 |

**PART E: Answer Any 1 Following Questions. 10 M**

| Q.N. | Questions | M | CO | BT |
|---|---|---|---|---|
| 12 | Control systems in industrial automation depend on signal and system analysis. Analyze the periodic signal $x(t)$shown in the figure and derive its Fourier series coefficients.<br> | 10 | CO4 | BT4 |

| | | | | |
|---|---|---|---|---|
| 13 | Smart watches process biological signals to track health parameters. Analyze the spectral content of the given signal by deriving its Fourier Transform and interpreting the resulting frequency components.<br><br> | 10 | CO4 | BT4 |