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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 09/01/2025 **Time:** 01:00 pm – 04:00 pm |

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| **School:** SOE | **Program:** B.Tech - EEE | |
| **Course Code :** EEE2026 | **Course Name :** Signals & Systems | |
| **Semester**: III | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **8** | **22** | **48** | **22** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

|  |  |  |  |  |
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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | Recall the concept of non periodic signals | 2 Marks | **L1** | **CO1** |
| **2** | What is the concept of Laplace transform | 2 Marks | **L1** | **CO3** |
| **3** | Recall the concept of z transform? | 2 Marks | **L1** | **CO4** |
| **4** | What sequence is followed for time based operation on signals | 2 Marks | **L1** | **CO1** |
| **5** | List any 2 Properties of Laplace transform. | 2 Marks | **L1** | **CO3** |
| **6** | Recall the concept of Energy signals | 2 Marks | **L1** | **CO1** |
| **7** | Define initial value theorem | 2 Marks | **L1** | **CO3** |
| **8** | Recall the concept of Final value theorem | 2 Marks | **L1** | **CO3** |
| **9** | List any two dirichlet conditions | 2 Marks | **L1** | **CO2** |
| **10** | Relate Ramp and unit step signal | 2 Marks | **L1** | **CO1** |

**Part B**

|  |  |  |  |  |  |  |  |  |  |  |
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| **Answer the Questions Total 80 Marks.** | | | | | | | | | | |
| **11.** | | **a.** | | A mathematician was plotting the Region of Convergence (ROC) of a given signal x(t). Region of Convergence (ROC) is defined as the set of points in s-plane for which the Laplace transform of a function x(t) converges. In other words, the range of Re(s) (i.e. σ) for which the function X(s) converges is called the region of convergence. The signal x(t) is an addition of two different signals and it was observed that the ROC is σ<-2 for one signal and σ>4 for the other signal. By referring to the above statements, outline the final equation of x(t) in terms of t and also comment on the stability of the signal. (Hint-The Signal x(t) is a combination of exponential one sided signals). | | 10 Marks | | **L2** | **CO3** | |
|  | | **b.** | | Apply the concept of calculation of energy and power for rectangular signals and also apply laplace transform to that signal. | | 10 Marks | | **L3** | **CO3** | |
| **Or** | | | | | | | | | | |
| **12.** | | **a.** | | A manufacturer has designed an inverter for integrating solar system to grid. The output waveform of an inverter circuit is a square wave of peak amplitude A. It is an even half wave symmetric signal. Summarize about the harmonics that would be present in this signal along with the formulas of fourier coefficients. | | 10 Marks | | **L2** | **CO3** | |
|  | | **b.** | | Relate energy and power signal concept to Laplace transform. Explain with an example. | | 10 Marks | | **L2** | **CO3** | |
|  | |  | |  | |  | |  |  | |
| **13.** | | **a.** | | Model electric circuit for explanation of the concept of impulse signal. | | 10 Marks | | **L2** | **CO2** | |
|  | | **b.** | | The flux waveform in a transformer core is trapezoidal in nature whose equation is given by 3r(t)-3r(t-4)-3r(t-6)+3r(t-8)+3r(t-10). Here the time delay given in the question is in milliseconds. Show the rough diagram of the waveform. | | 10 Marks | | **L2** | **CO2** | |
| **Or** | | | | | | | | | | |
| **14.** | | **a.** | | Model an electric circuit for explanation of the concept of time advance and time delay operations. | | 10 Marks | | **L1** | **CO2** | |
|  | | **b.** | | Identify signum signal falls under the category of energy, power or NENP signal and compute the energy and power of any rectangular signal of your choice. | | 10 Marks | | **L1** | **CO2** | |
|  | |  | |  | |  | |  |  | |
| **15.** | | **a.** | | Interpret the convolution of x(t)=u(t+2)-u(t-2) and h(t)=δ(t+2)-δ(t-2) by using properties of convolution. | | 10 Marks | | **L2** | | **CO3** |
|  | | **b.** | | Summarize the concept of Fourier series and its role in representing continuous-time periodic signals | | 10 Marks | | L2 | | CO3 |
| **Or** | | | | | | | | | | |
| **16.** | | **a.** | | A manufacturer has designed an inverter. The output waveform of an inverter circuit is given below. **IMG_257**  Summarize about the harmonics that would be present in this signal. | | 10 Marks | | **L2** | | **CO3** |
|  | | b. | | A DC voltage of 5 Volts was applied to an electrical circuit using a Battery comprising a Resistor, capacitor and a switch. All the elements are connected in series The value of Resistor is 1000 Ohms and capacitance is 3 micro-farads. The switched was initially open but at t=0 the switch has been closed and a transient response was observed. The battery was charging the capacitor to a steady state value. The voltage source in series with the switch gives rise to a type of Signal. After drawing the source signal, explain what will happen to the source signal if the switch is closed at t=to instead of t=0 with the help of conceptual explanations. Also compute the laplace transform of the signal. | | 10 Marks | | **L1** | | **CO3** |

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| 17. | a. | A voltage having the Laplace transform (3s^2 + 2s + 1)/ (6s^2 + 4s + 3) is applied across a 2H inductor having zero initial current. It is desired to compute the current flowing through the inductor at steady state. Utilizing the Final value theorem solve for the current flowing through the inductor at steady state. | 10 Marks | **L3** | **CO4** |
|  | **b.** | A Transfer function X(s)=N(s)/D(s) has a zero at -2 and 2 poles at 0 and -2. Solve for intial value and final value. | 10 Marks | **L3** | **CO4** |
| **Or** | | | | | |
| **18.** | **a.** | Solve for the Z-Transform of the discrete-time signal x(n) = anu(n) for n≥0 and also comment on the R.O.C. | 10 Marks | **L3** | **CO4** |
|  | **b.** | With the help of the concept of sampling, explain the transition from Continuos time Fourier transform to Discrete time Fourier transform and Discrete Fourier transform. | 10 Marks | **L2** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***