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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 03 -01-2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** B. TECH - EEE | |
| **Course Code :** EEE2007 | **Course Name :** Control System Engineering | |
| **Semester**: V | **Max Marks**:100 | **Weightage**:50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **24** | **24** | **24** | **4** | **24** |

**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. 10 x 2 Marks=20 Marks** | | | | |
| **1** | The open loop and closed loop are the two types of control systems*.*List the differences between Open loop and Closed loop control systems | **2 Marks** | **L1** | **CO1** |
| **2** | List the block diagram reduction rules for the cases given below.   1. Shifting a takeoff point or branch point after the block 2. Shifting a takeoff point or branch point before the block | **2 Marks** | **L1** | **CO1** |
| **3** | The performance characteristics of a control system are specified in terms of the transient response to unit step input. The transient response of a practical control system exhibits damped oscillations before attaining the steady state. Define the following performance indices that are used to characterize the step response to a second order system.              (a) Peak time (b) Settling time | **2 Marks** | **L1** | **CO2** |
| **4** | Define the type and order of a system with examples | **2 Marks** | **L1** | **CO2** |
| **5** | Stability is the most desired property in designing of control systems. Define the Absolute Stability & Relative Stability | **2 Marks** | **L1** | **CO3** |
| **6** | List the procedure to find asymptotes and centroid in Root locus**.** | **2 Marks** | **L1** | **CO3** |
| **7** | List the role of compensators in a control system | **2 Marks** | **L1** | **CO4** |
| **8** | Recall the circuit diagram for Phase lead compensator | **2 Marks** | **L1** | **CO4** |
| **9** | Recall the state model of a linear time invariant system | **2 Marks** | **L1** | **CO5** |
| **10** | What is the expression to convert the state model into Transfer function | **2 Marks** | **L1** | **CO5** |

**Part B**

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| **Answer the Questions Total 80 Marks.** | | | | | |
| **11.** | **a.** | Explain the differential equations governing the following mechanical system. Outline the transfer function of the system. | **15 Marks** | **L2** | **CO1** |
|  | **b.** | Control theory strongly relies on mathematical models of dynamical systems. Depending on how a dynamical system is modelled, an appropriate control strategy must be selected. Most of the electrical systems can be modelled by three basic elements: Resistor, inductor, and capacitor. Consider a circuit in which these elements are connected in series and outline its transfer function**.** | **5 Marks** | **L2** | **CO1** |
| **or** | | | | | |
| **12.** | **a.** | Using Block diagram reduction techniques interpret the transfer function of the system given below. | **15 Marks** | **L2** | **CO1** |
|  | **b.** | Explain Mason’s Gain Formula | **5 Marks** | **L2** | **CO1** |
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| **13.** | **a.** | Select the value of K for the feedback system given below, so that the system will respond with a 10% overshoot. | **10 Marks** | **L2** | **CO2** |
|  | **b.** | Consider the following closed loop control systemwhere  ​  If the steady state error for a unit ramp input is 0.1, identify the value of K | **10 Marks** | **L2** | **CO2** |
| **or** | | | | | |
| **14.** | **a.** | The robot arms used in industrial manufacturing require control of the position of the end piece. The simplified block diagram model of the system is shown below and has parameters ζ = 0.6 and ωn = 5rad / sec. The system is subjected to a unit step input, Estimate all the possible time response specification and comment on its performance. | **10 Marks** | **L2** | **CO2** |
|  | **b.** | A unity negative feedback system has an open-loop transfer function    Identify the gain for the system to have a damping ratio of 0.25. | **10 Marks** | **L2** | **CO2** |

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| **15.** | **a.** | Apply R-H criteria to identify the stability of the system with the characteristic equation given below. | **10 Marks** | **L3** | **CO3** |
|  | **b.** | Consider the magnitude plot of the open-loop T.F. given below and develop its transfer function. | **10 Marks** | **L3** | **CO3** |
| **Or** | | | | | |
| **16.** | **a.** | Sketch the root locus for the open loop transfer function of unity feedback control system given below  G (s) H(s) = K / s (s+1) (s+3)  1.Identify the breakaway point, Imaginary axis cross point  2. Comment on stability. | **20 Marks** | **L3** | **CO3** |

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| **17.** | **a.** | Compute the state model of the electric circuit given below. | **10 Marks** | **L2** | **CO5** |
|  | **b.** | Infer the transfer function from the given state model | **10 Marks** | **L2** | **CO5** |
| **Or** | | | | | |
| **18.** | **a.** | Explain the terms controllability and observability of a linear system and the method to determine the same | **10 Marks** | **L2** | **CO5** |
|  | **b.** | While developing an automatic control system, its verified that system is stable and need to check the controllability and observability. Suggest suitable methods for the same and identify the controllability and observability of the system given below. | **10 Marks** | **L2** | **CO5** |

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