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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 08 / 01/ 2025 **Time:** 09:30 am –12:30 pm |

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| **School:** SOE | **Program:** B. Tech. (Mechanical Engineering) (Mechatronics) |
| **Course Code :** MEC3063 | **Course Name:** Control Engineering |
| **Semester**: V | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **24** | **24** | **26** | **26** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*
3. *Use of Design Data Handbook permitted.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** |
| **1** | Define the term 'plant' in control systems. | **2 Marks** | **L1** | **CO1** |
| **2** | What is the purpose of an integral control mode? | **2 Marks** | **L1** | **CO1** |
| **3** | What is viscous friction? | **2 Marks** | **L1** | **CO2** |
| **4** | What is the role of a mass element in a mechanical system? | **2 Marks** | **L1** | **CO2** |
| **5** | State two advantages of using block diagrams for system analysis. | **2 Marks** | **L1** | **CO3** |
| **6** | Define a transfer function and its importance in control systems. | **2 Marks** | **L1** | **CO3** |
| **7** | What are the basic elements represented in a block diagram? | **2 Marks** | **L1** | **CO3** |
| **8** | Define root locus and its significance. | **2 Marks** | **L1** | **CO4** |
| **9** | What is the importance of frequency response analysis in control systems? | **2 Marks** | **L1** | **CO4** |
| **10** | List two applications of root locus plots. | **2 Marks** | **L1** | **CO4** |

**Part B**

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| **Answer the Questions Total 80 Marks.** |
| **11.** | Construct a model of a Missile Launching System and represent it using a closed-loop block diagram. | **20 Marks** | **L3** | **CO1** |
| **or** |
| **12.** | Construct a model of a residential heating system and represent it using a closed-loop block diagram. | **20 Marks** | **L3** | **CO1** |
|  |  |  |  |  |  |
| **13.** | Analyze the given RLC circuit and derive the transfer function using Kirchhoff's laws and Laplace transformations. | **20 Marks** | **L4** | **CO2** |
| **or** |
| **14.** | Consider a simple system with a mass that is separated from a wall by a spring and a dashpot. The mass could represent a car, with the spring and dashpot representing the car's bumper. An external force is also shown. Only horizontal motion and forces are considered. Predict TF for displacement in mass 2. | **20 Marks** | **L4** | **CO2** |

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| **15.** | Simplify the given block diagram representation of the system and derive the closed-loop transfer function by applying block diagram reduction techniques. | **20 Marks** | **L5** | **CO3** |
| **Or** |
| **16.** | Interpret the given signal flow graph of the control system and determine the system's characteristic equation by applying Mason’s Gain Formula.**A diagram of a diagram  Description automatically generated** | **20 Marks** | **L5** | **CO3** |

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| **17.** | a) Apply appropriate methods such as the Routh-Hurwitz criterion, based on the system's representation, and justify your conclusions regarding the stability of the system.A black and blue numbers  Description automatically generated with medium confidenceb) Find the range of values of k for which the system would be stable | **20 Marks** | **L5** | **CO4** |
| **Or** |
| **18.** | The open loop transfer function of a unity negative feedback system is given by  Draw the root locus as the value of k varies from zero to Infinity. | **20 Marks** | **L5** | **CO4** |