|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Roll No. |  |  |  |  |  |  |  |  |  |  |  |  |



**PRESIDENCY UNIVERSITY**

**Bengaluru**

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

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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 confidence  b) 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** |