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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 -ECE | |
| **Course Code :** ECE3006 | **Course Name :** Digital control Systems | |
| **Semester**: V | **Max Marks**:100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **50** | **08** | **22** | **20** |

**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** | Why is positive feedback not preferred in control systems for stable outputs? Can you think of any applications where Negative feedback is useful? | **2 Marks** | **L2** | **CO1** |
| **2** | For a second-order underdamped system with a natural frequency = 25rad/s and a damping ratio =0.35.Find the rise time and peak time. | **2 Marks** | **L2** | **CO2** |
| **3** | Consider a second order system with a closed loop transfer function. find out damping factor and natural frequency | **2 Marks** | **L2** | **CO2** |
| **4** | Define rise time and peak time of a first order system | **2 Marks** | **L2** | **CO2** |
| **5** | Why is feedback so critical in control systems? Can you give examples where feedback can be both beneficial and detrimental? | **2 Marks** | **L2** | **CO1** |
| **6** | Bode plot is a powerful method of stability analysis, where frequency is taken in logarithmic scale along X axis to cover a large band of frequency. Briefly discus the concept of Gain margin and Phase margin with respect to Bode plot. | **2 Marks** | **L2** | **CO3** |
| **7** | Why is it important to simplify block diagrams when analyzing control systems? What challenges arise when dealing with complex systems? | **2 Marks** | **L2** | **CO1** |
| **8** | If a system has negative feedback added to one of its parallel branches, how would this impact the overall transfer function? | **2 Marks** | **L2** | **CO1** |
| **9** | We can classify second order systems based on their damping ratio. Consider a second order system with a closed loop transfer function    Classify the system based on the damping. | **2 Marks** | **L2** | **CO2** |
| **10** | Standard test signals are used to analyse a particular system by giving these inputs to the systems. In control systems, many standard test signals are used. Define a unit impulse signal and write its Laplace transform. | **2 Marks** | **L2** | **CO1** |

**Part B**

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| **Answer the Questions Total 80 Marks.** | | | | | |
| **11.** | **a.** | Mr. Vivek is analyzing a system with the block diagram as below. He wants to check the stability of the system by finding the poles of the system. For this he require the closed loop transfer function of the system    Using Mason's Gain formula estimate the transfer function and hence quote whether the system is stable. | **20 Marks** | **L3** | **CO1** |
| **or** | | | | | |  |  | **20 Marks** | **L** | **CO** |
| **12.** | **a.**  **b.** | Draw the SFG for the set of equations  Now from the signal flow graph find the transfer function, using Mason’s Gain Formula.  Draw the signal flow graph for the given set of equations find the transfer function, using Mason’s Gain Formula. | **20 Marks** | **L3** | **CO1** |
| **13.** | **a.** | Mr. Ram is an engineer at Indian Space Research Organization. He is analyzing a system with the following open loop transfer function  G(s)H(s)=\frac{K(s+2)}{(s-4)(s+1)}  He wants to design a controller for the system to meet some specifications. He is planning to use Root Locus as his design method.   * Obtain the root locus plot. * Find the centroid and angles of asymptotes. * Determine the range of K for system stability. | **20 Marks** | **L3** | **CO3** |
| **or** | | | | | |
| **14.** | **a.** | Mr. Krishna is an engineer at Hindustan Aeronautics Limited(HAL). He is analyzing a system with the following open loop transfer function.     * Sketch the root locus for the given system. * Find the condition for stability and determine the value of K at the stability boundary. | **20 Marks** | **L3** | **CO3** |

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| **15.** | **a.** | Block diagram reduction is an essential method, which can be used to represent a complex system using a single block. If the block diagram is converted into a Signal Flow Graph which is the graphical representation of the complete block diagram, it becomes easy to find the closed loop transfer function using Mason’s Gain Formula.  Consider the following Mr. Suraj wants to do some analysis of the block diagram to check what will be the output if a certain input is given. For that he is planning to do a transfer function modelling so that he can use MATLAB to model the system.block diagram   * Use block diagram reduction rule to find the closed loop transfer function * (b) Now verify your answer using Mason’s Gain Formula so that Mr. Suraj can be sure of the answer he got in part (a) | **20 Marks** | **L3** | **CO1** |
| **Or** | | | | | |
| **16.** | **a.** | Block diagram reduction is an essential method, which can be used to represent a complex system using a single block. If the block diagram is converted into a Signal Flow Graph which is the graphical representation of the complete block diagram, it becomes easy to find the closed loop transfer function using Mason’s Gain Formula. Consider the following block diagram  Mr. Kiran wants to do some analysis of the block diagram to check what will be the output if a certain input is given. For that he is planning to do a transfer function modelling so that he can use MATLAB to model the system.   * Use block diagram reduction rule to find the closed loop transfer function * Now verify your answer using Mason’s Gain Formula so that Mr. Kiran can be sure of the answer he got in part (a) | **20 Marks** | **L3** | **CO1** |

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| **17.** | **a.** | Transfer function relates output ans input in S domain.In engineering a transfer function of a system, sub-system or component is a mathematical function that theoretically models the system's output for each possible input. They are widely used in electronics and control systems. A project student comes up with the below mentioned transfer functions. His manager asks the trainee to get the space model for the transfer functions given below. Help the trainee to get the space model. | **20 Marks** | **L3** | **CO4** |
| **Or** | | | | | |
| **18.** | **a.** | A control system is said to be controllable if the initial states of the control system are transferred to some other desired states by a controlled input in finite duration of time. Check the controllability of the system and also transfer function. | **20 Marks** | **L3** | **CO4** |