**20EE503**

**Hall Ticket Number:**

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| **III/IV B.Tech (Supplementary) DEGREE EXAMINATION** | | | |
| **July/August,2023** | **Electrical &Electronics Engineering** | | |
| **Fifth Semester** | **Control Systems** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X14=56 Marks) |

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| 1. | a) | Draw the block diagram for closed loop control system | CO1 | L2 | 1M |
|  | b) | What is mathematical model? What are the different types? | CO1 | L1 | 1M |
|  | c) | Explain the advantages and disadvantages of closed loop control systems | CO1 | L2 | 1M |
|  | d) | What is steady state error | CO2 | L1 | 1M |
|  | e) | Identify type and order of the following system | CO2 | L3 | 1M |
|  | f) | What is meant by un-damped response | CO2 | L1 | 1M |
|  | g) | Explain the Properties of Hurwitz Polynomials. | CO3 | L2 | 1M |
|  | h) | Define Phase Margin. | CO4 | L1 | 1M |
|  | i) | Define gain –cross over frequency. | CO4 | L1 | 1M |
|  | j) | Draw polar plot for G(S)=(1+ST) | CO4 | L2 | 1M |
|  | k) | Summarize the effects of PI Controller on the system performance | CO5 | L2 | 1M |
|  | l) | Define state and state variable | CO6 | L1 | 1M |
|  | m) | List out the advantages of state space analysis? | CO6 | L1 | 1M |
|  | n) | Define Observability. | CO6 | L1 | 1M |
| **Unit -I** | | | | | |
| 2. | a) | Sketch the equivalent signal flow graph and solve the overall transfer function using Mason’s gain formula.    Fig.1 | CO1 | L3 | 7M |
|  | b) | Develop the differential equations governing the Mechanical rotational system shown in fig2.    Fig.2 | CO1 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 3. | a) | Consider the mechanical system shown in fig.3. Identify the variables and write the differential equation.    Fig.3 | CO1 | L3 | 7M |
|  | b) | For the system represented by block diagram shown in figure4. Determine Y(s) /R(s).    Fig.4 | CO4 | L1 | 7M |
| **P.T.O**  **20EE503**  **Unit -II** | | | | | |
| 4. | a) | For a unity feedback system whose open loop transfer function is  solve the position, velocity & acceleration error Constants. | CO2 | L3 | 7M |
|  | b) | Consider the characteristic equation.  Analyze stability using Routh’s criterion. | CO3 | L4 | 7M |
|  |  | **(OR)** |  |  |  |
| 5. | a) | The closed loop transfer function of a unity feedback control system is given by  Solve  i) Damping ratio  ii) Natural undammed resonance frequency  iii) Damped frequency of oscillations  iv) Rise time. | CO3 | L1 | 7M |
|  | b) | The open loop transfer function of a system is . Determine the range of K for stability of the system using Routh criterion. Also find value of K which causes sustained oscillations and frequency of oscillations. | CO4 | L3 | 7M |
|  |  | **Unit -III** | |  |  |
| 6. | a) | Construct the root locus of the system whose open loop transfer function  . | CO3 | L4 | 7M |
|  | b) | Sketch the Bode plot for the given open loop transfer function.  . Determine gain margin, phase margin. | CO3 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 7. | a) | Define root locus and state the rules to construct the root locus. | CO2 | L1 | 7M |
|  | b) | A unity feedback control system has an open loop transfer function given by  G(S)H(S)= | CO4 | L2 | 7M |
|  |  | **Unit -IV** |  |  |  |
| 8. | a) | Derive the transfer function and draw the pole-zero plot for the Lead compensator. | CO4 | L1 | 7M |
|  | b) | For the matrix A= . Find the state transition matrix. | CO3 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 9. | a) | What is the effect of Proportional derivative controller on stability of a system. | CO2 | L2 | 7M |
|  | b) | Determine the state model of a system which has the following governing differential equation | CO4 | L3 | 7M |

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