**20EE503**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION** | | | |
| **December, 2023** | **Electrical and Electronics Engineering** | | |
| **Fifth Semester** | **Control Systems** | | |
| **Time:** Three Hours | | **Maximum:** 70 Marks | |
| ***Answer question 1 compulsory.*** | | | **(14X1 = 14Marks)** |
| ***Answer one question from each unit.*** | | | **(4X14=56 Marks)** |
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|  |  |  | CO | BL | M |
| 1 | a) | Explain how feedback affects the Overall gain of the system. | CO 1 | L1 | 1M |
|  | b) | What is a take-off Point or branch point? | CO 1 | L1 | 1M |
|  | c) | Define Steady State response and steady-state error. | CO 1 | L1 | 1M |
|  | d) | Draw the (i) Step signal and (ii) Ramp signal | CO 2 | L2 | 1M |
|  | e) | Write any two limitations of Routh’s stability. | CO 2 | L1 | 1M |
|  | f) | Define steady state response | CO 2 | L1 | 1M |
|  | g) | What is the difference between type and order of a system | CO 2 | L1 | 1M |
|  | h) | What is “Angle of Departure”? | CO 3 | L1 | 1M |
|  | i) | What is Gain cross over frequency? | CO 3 | L1 | 1M |
|  | j) | List the frequency domain specifications. | CO 3 | L1 | 1M |
|  | k) | Why bode plots are commonly used in the frequency domain design? | CO 3 | L1 | 1M |
|  | l) | What is controllability? | CO 4 | L1 | 1M |
|  | m) | Draw the polar plot of lag-lead compensator. | CO 4 | L2 | 1M |
|  | n) | What are the advantages of canonical form? | CO 4 | L1 | 1M |
| **Unit-I** | | | | | |
| 2 | a) | Find the transfer function for the Block diagram shown in the figure. | CO 1 | L3 | 8M |
|  | b) | Distinguish between Open loop control system and closed loop control system. | CO 1 | L2 | 6M |
| **(OR)** | | | | | |
| 3 | a) | Write the differential equations governing the Mechanical system shown in fig. and determine the transfer function. | CO 1 | L2 | 7M |
|  | b) | Find the transfer function of the system shown in figure using Mason’s gain formula? |  |  | 7M |
| **Unit-II** | | | | | |
| 4 | a) | Test the stability of the system with the following characteristic equation by Routh’s test: s6 + 4s5 + 3s4 + 12s2 + 9s + 14 = 0. | CO 2 | L3 | 7M |
|  | b) | Derive expressions for the steady state errors of type – 0, type – 1 and type – 2 systems excited by a unit-step input | CO 2 | L3 | 7M |
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| **(OR)** | | | | | |
| 5 | a) | Write the equations for time domain specifications of a standard second-order system with unit step input? | CO 2 | L2 | 6M |
|  | b) | The open-loop transfer function of a control system with unity feedback is  (i) Determine the Error series  (ii) Determine the steady state error for an input r(t) = (1+t2 ) u(t) | CO 2 | L2 | 8M |
| **Unit-III** | | | | | |
| 6 | a) | Sketch the Bode plot and hence find the Gain cross-over frequency, Phase cross-over frequency, Gain margin and Phase margin for the system equation given below. | CO 3 | L3 | 10M |
|  | b) | Discuss about the frequency domain specifications. | CO 3 | L2 | 4M |
| **(OR)** | | | | | |
| 7 | a) | A unity feedback system has an open-loop function  Sketch the root locus and determine the value of ‘k’ for stability. | CO 3 | L3 | 10M |
|  | b) | Explain the construction rules for the root locus technique. | CO 3 | L2 | 4M |
| **Unit-IV** | | | | | |
| 8 | a) | For the given open loop transfer function,  Design suitable lead compensation so that the phase margin is ≥ 400 and the velocity error is constant, Kv ≥ 20. | CO 4 | L4 | 10M |
|  | b) | List the limitations of lag, lead, and lag-lead compensators. | CO 4 | L2 | 4M |
| **(OR)** | | | | | |
| 9 | a) | Determine the state model of the system for the following transfer function | CO 4 | L3 | 7M |
|  | b) | Given the system,    Where,  Determine the state controllability, output controllability and observability of the system | CO 4 | L3 | 7M |

