**20EI501**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION** | | | |
| **December, 2023** | **Electronics and Instrumentation 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) | State Mason’s gain formula. | CO1 | BL1 | 1M |
|  | b) | List the time domain specifications. | CO2 | BL2 | 1M |
|  | c) | Write the necessary and sufficient condition for stability. | CO2 | BL1 | 1M |
|  | d) | Define Steady state error. | CO2 | BL1 | 1M |
|  | e) | Define BIBO stability. | CO3 | BL1 | 1M |
|  | f) | What are the advantages of Bode plot? | CO3 | BL1 | 1M |
|  | g) | What are frequency domain specifications? | CO3 | BL1 | 1M |
|  | h) | What is meant by damping in root locus diagram? | CO4 | BL1 | 1M |
|  | i) | What is the effect of positive feedback on stability? | CO3 | BL1 | 1M |
|  | j) | What are the advantages of Nyquist stability criterion? | CO3 | BL1 | 1M |
|  | k) | Define Gain margin and Phase margin. | CO3 | BL1 | 1M |
|  | l) | What are the advantages of frequency response analysis? | CO4 | BL1 | 1M |
|  | m) | State various properties of state transition matrix. | CO4 | BL1 | 1M |
|  | n) | What are the advantages of state space analysis over transfer function analysis? | CO4 | BL1 | 1M |
| **Unit-I** | | | | | |
| 2 | a) | Compare open loop and closed loop control system with an example. | CO1 | BL3 | 7M |
|  | b) | Explain clearly the effect of feedback on overall gain, stability, external disturbance or noise and sensitivity of a control system. | CO1 | BL2 | 7M |
| **(OR)** | | | | | |
| 3 | a) | List the properties of signal flow graphs. | CO1 | BL2 | 7M |
|  | b) | Derive the differential equations governing the mechanical translational system shown in the below figure. | CO1 | BL3 | 7M |
| **Unit-II** | | | | | |
| 4 | a) | Derive the expression for the time response of an underdamped second order system when subjected to unit step input. | CO2 | BL3 | 7M |
|  | b) | The open loop transfer function of the system G(s) = 5/ S(S+2).  Determine i) Rise time ii) Peak time iii) Peak overshoot iv) Settling time. | CO2 | BL3 | 7M |
| **(OR)** | | | | | |
| 5 | a) | Outline stability study based on poles of closed loop transfer function with examples. | CO2 | BL4 | 7M |
|  | b) | Illustrate the Routh-Hurwitz criteria with an example. | CO2 | BL3 | 7M |
| **Unit-III** | | | | | |
| 6 | a) | Define gain cross over frequency, phase cross over frequency, gain margin and phase margin. | CO3 | BL1 | 7M |
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|  | b) | Sketch the polar plot for the transfer function G(s) = 1/ S2 (2S+1). | CO3 | BL3 | 7M |
| **(OR)** | | | | | |
| 7 | a) | Describe the procedural steps to be followed to construct Bode plot. | CO3 | BL1 | 7M |
|  | b) | Sketch the Nyquist plot and there from determine the stability of the closed loop system whose open loop transfer function is given by  G(s). H(s) = S+2/ (S+1) (S-1). | CO3 | BL3 | 7M |
| **Unit-IV** | | | | | |
| 8 | a) | Describe the construction rules to draw root locus of a given transfer function. | CO4 | BL2 | 7M |
|  | b) | Sketch the Root locus plot for a unity feedback system with an open loop transfer function G(s) = K(S+3)/ S(S+2). | CO4 | BL3 | 7M |
| **(OR)** | | | | | |
| 9 | a) | Outline the concept of Controllability and Observability. | CO4 | BL3 | 7M |
|  | b) | Distinguish between transfer function model and state space model. | CO4 | BL3 | 7M |

