

Time: 3 Hours

Max. Marks: 70

PART-A

(Answer all the Questions 10 x 2 = 20 Marks)

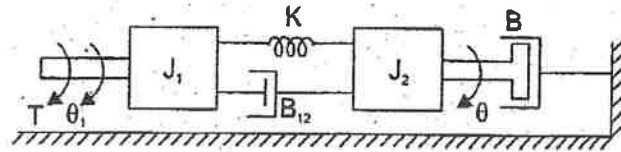
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|-----|---|-----|----|----|
| 1 a | What is Control Systems? Define Closed loop control system. | CO1 | L1 | 2M |
| b | Write the Mason's gain formula. | CO1 | L1 | 2M |
| c | Name the test signals used in control systems. | CO2 | L1 | 2M |
| d | What is steady state error? | CO2 | L1 | 2M |
| e | Define the Root locus. | CO3 | L1 | 2M |
| f | Describe the characteristic equation. | CO3 | L2 | 2M |
| g | List the frequency domain specifications. | CO4 | L1 | 2M |
| h | What is a Bode plot? | CO4 | L1 | 2M |
| i | Write the properties of state transition matrix. | CO5 | L1 | 2M |
| j | What is state diagram? | CO5 | L1 | 2M |

PART-B

(Answer all Five Units 5 x 10 = 50 Marks)

UNIT-I

- 2 Write the differential equations governing the mechanical rotational system shown in the figure and find transfer function. CO1 L3 10M



OR

- 3 a Give the block diagram reduction rules to find the transfer function of the System. CO1 L3 5M
b List the properties of signal flow graph. CO1 L2 5M

UNIT-II

- 4 Obtain the time response of un-damped second order system for unit step input. CO2 L3 10M

OR

- 5 a A For servo mechanisms with open loop transfer function given below what type of input signal give rise to a constant steady state error and calculate their values. $G(s)H(s) = \frac{20(s+2)}{s(s+1)(s+3)}$. CO2 L3 5M
b Consider a unity feedback system with a closed loop transfer function $\frac{C(s)}{R(s)} = \frac{Ks+b}{(s^2+as+b)}$. Calculate open loop transfer function G(s). Show that steady state error with unit ramp input is given by $\frac{(a-K)}{b}$. CO2 L4 5M

UNIT-III

- 6 With the help of Routh's stability criterion find the stability of the following systems represented by the characteristic equations CO3 L3
(i) $S^4 + 8S^3 + 18S^2 + 16S + 5 = 0$
(ii) $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$

OR

- 7 Develop the root locus of the system whose open loop transfer function is CO3 L3
 $G(S) = \frac{K}{s(s+2)(s+4)}$

UNIT-IV

- 8 Develop the Bode plot for the following transfer function and determine the system phase and gain cross over frequencies. CO4 L4

$$G(S) = \frac{10}{S(1+0.4S)(1+0.1S)^2}$$

OR

- 9 Sketch the polar plot for the open loop transfer function of a unity feedback system is given by $G(S) = \frac{1}{S(1+S)^2}$. Determine Gain Margin & Phase Margin. CO4 L3

UNIT-V

- 10 Determine the Solution for Homogeneous and Non homogeneous State equations. CO5 L3

OR

- 11 State whether the system is controllable and observable for the linear time invariant system characterized by the state model. CO5 L2

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u, Y(t) = [1 \quad 1] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

*** END ***