R16

Reg. No:

SIDDHARTH INSTITUTE OF ENGINEERING &TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
B.Tech III Year I Semester Supplementary Examinations July-2022
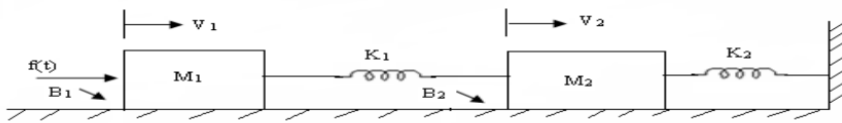**LINEAR CONTROL SYSTEMS**
(Common to EEE & ECE)

Time: 3 hours   Max. Marks:60

(Answer all Five Units **5 x 12 = 60** Marks)

UNIT-I

1 For the mechanical system shown in the figure draw the force-voltage and force-current analogous circuits. **L3 12M**

OR

2 a Derive the transfer function for A.C servo motor with neat diagram? **L2 8M**

   b Derive the transfer function for synchro with neat diagram? **L2 4M**

UNIT-II

3 a Measurements conducted on a servo mechanism, show the system response to be $c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$ When subject to a unit step input. Obtain an expression for closed loop transfer function, determine the undamped natural frequency, damping ratio? **L3 6M**

   b 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. **L3 6M**

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

OR

4 What is meant steady state error? Derive the static error components for Type 0, Type 1 & Type 2 systems. **L3 12M**

UNIT-III

5 The characteristic equation of a feedback control system is $S^4 + 3S^2 + 12S^2 + (K-16)S + K = 0$. Sketch the root locus plot for $0 < K <$ infinity. Determine the range of gain for which the system is stable. **L3 12M**

OR

6 Sketch the root locus of the system whose open loop transfer function is   **L3**   **12M**

$$G(S)H(S) = \frac{K}{S(S+4)(S^2+4S+20)}$$

UNIT-IV

7 **a** Define and derive the expression for resonant frequency.   **L2**   **6M**

   b Draw the magnitude bode plot for the system having the following transfer   **L3**   **6M**
function.

$$G(S)H(S) = \frac{2000\,(S+1)}{S\,(S+10)(S+40)}$$

OR

8 **a** Given $\xi = 0.7$ and $\omega_n = 10$ rad/sec. Find resonant peak, resonant frequency and   **L3**   **6M**
bandwidth.

   b Sketch the polar plot for the open loop transfer function of a unity feedback system   **L3**   **6M**
is given by $G(S) = \frac{1}{S(S+1)1+2S}$. Determine Gain Margin & Phase Margin.

UNIT-V

9 **a** Derive the expression for the transfer function and poles of the system from the   **L3**   **6M**
state model.

$\dot{X} = Ax + Bu$ and $y = Cx + Du$

   b Diagonalize the following system matrix $A = \begin{pmatrix} 4 & 1 & -2 \\ 1 & 0 & 2 \\ 1 & -1 & 3 \end{pmatrix}$ **L3**   **6M**

OR

10 Determine the Solution for Homogeneous and Non homogeneous State equations   **L2**   **12M**

*** END ***