Q.P. Code: 16EE216 **R16**

Reg. No: | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B.Tech III Year I Semester Regular & Supplementary Examinations Nov/Dec 2019

LINEAR CONTROL SYSTEMS

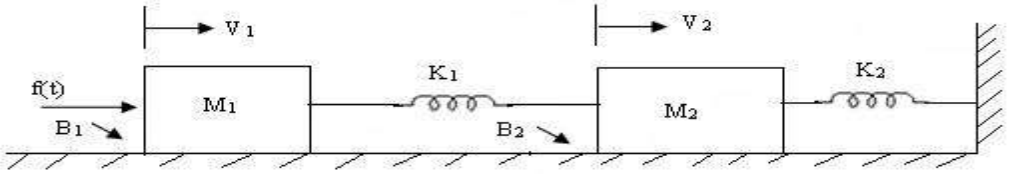
(EEE & ECE)

Time: 3 hours Max. Marks: 60

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

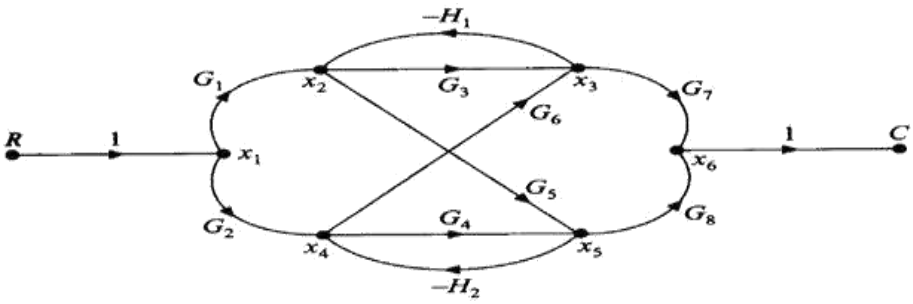
UNIT-I

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



OR

2 Using Mason's gain formula find the transfer function for the signal flow graph shown in below figure. 12M



UNIT-II

3 List the various time domain specifications and derive the expressions for Rise time, Peak time and Peak overshoot. 12M

OR

4 **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. 6M

G(S)H(S) = $\frac{20(S+2)}{S(S+1)(S+3)}$

b Consider a unity feedback control system with a closed loop transfer function $\frac{C(S)}{R(S)} = \frac{Ks+b}{S^2+aS+b}$. Determine the open loop transfer function G(s). Obtain the steady state error for unit ramp signal. 6M

UNIT-III

5 **a** The open loop transfer function of a unity feedback system is given by 8M
G(S) = $\frac{K(s+1)}{(S^3+aS^2+2S+1)}$ .Determine the value of 'K' and 'a' so that system oscillates at a frequency of 2 rad/sec.

b Explain the effect of adding poles and zeros to characteristic equation on stability of the root loci. 4M

OR

6 Sketch the root locus of the system whose open loop transfer function is 12M
G(S) H(S) = $\frac{K}{S(S+4)(S^2+4S+20)}$.

UNIT-IV

7 Draw the Bode plot for the following Transfer Function 12M
G(S) H(S) = $\frac{36(0.1S+1)}{S^2(0.2S+1)(0.02S+1)}$
From the bode plot determine (a) Gain Margin (b) Phase Margin (c) Comment on the stability.

OR

8 Draw the Nyquist plot for the system whose open loop transfer function is given by 12M
G(S) H(S) = $\frac{K}{S(S+2)(S+10)}$. Determine the range of K for which closed loop system is stable.

UNIT-V

9 **a** State the properties of state transition matrix. 4M

b For the state equation $\dot{X} = \begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}X + \begin{bmatrix}0\\ 1\end{bmatrix}U$; $X(0) = \begin{bmatrix}1\\ 0\end{bmatrix}$. 8M
Find the solution of state equation for unit step input.

OR

10 **a** Find the state model of differential equation $\dddot{Y} + 2\ddot{Y} + 3\dot{Y} + 4Y = 4$. 6M

b Diagonalize the following system matrix 6M

$$A = \begin{bmatrix}0 & 6 & -5\\ 1 & 0 & 2\\ 3 & 2 & 4\end{bmatrix}$$

*** END ***