EC 311 (R-20)

Total No. of Questions : 10] [Total No.of Pages : 03

III/IV B. Tech. DEGREE EXAMINATIONS, DECEMBER - 2022

First Semester

ELECTRONICS AND COMMUNICATIONS ENGINEERING

LINEAR CONTROL SYSTEMS

Time : **Three Hours** Maximum : **60** Marks

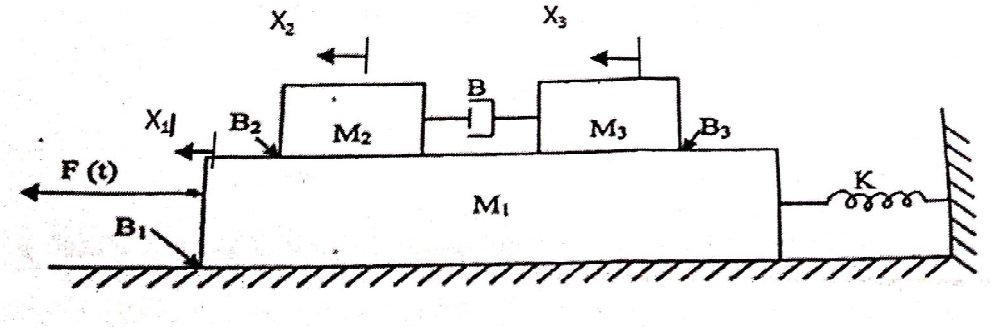
Answer ONE Question from each Unit.

All questions carry equal marks. 5x12=60 M

UNIT - I

1. a) Check the stability of the system given by the characteristic equation $P(s) = s^6 + 4s^5 + 2s^4 + 4s^3 + 8s^2 + 1s + 12$.

   b) Write the differential equations governing the mechanical system and hence draw the electrical analogous circuit.



(OR)

2. a) A unity feedback system has an open loop transfer function. Determine the stability of $\frac{10(s+2)}{(s(s+1)(s+5))}$.

   b) What is synchros ? Explain transmitter and receiver.

UNIT - II

3. a) Using Routh-Hurwitz criterion determine the relation between K and T so that unity feedback control system whose open loop transfer function given below is stable.

$$\frac{K}{s^2(s+1)+T}$$

P.T.O.

b) For a unity feedback control system the open loop transfer function $G(s) = \frac{10(s+2)}{s^2(s+1)}$. Determine the position, velocity and acceleration error constants.

(OR)

4. a) For a servo mechanisms with open loop transfer function $G(s) = \frac{20(s+2)}{s(s+1)(s+3)}$ what type of input signal give rise to a constant steady state error and calculate their values.

b) A unity feedback system is characterized by an open loop transfer function $G(s) = \frac{10}{s^2+5s+10}$, determine the transient response when subjected to unit step input and sketch the response.

UNIT - III

5. The open loop transfer function of system is given by $\frac{10}{s(s+1)(s+2)}$ draw the bode plot and obtain the ω_{gc} and ω_{pc}.

(OR)

6. a) Derive the expressions for resonant peak and resonant frequency and hence establish the correlation between time response and frequency response.

b) Draw the polar plot of open loop transfer function $\frac{1}{(s+7)(s+1)}$ and determine the GM.

UNIT - IV

7. a) Sketch the root locus of the systm whose open loop transfer function is

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}$$

b) Explain about Lead-Lag compensation ?

(OR)

8. a) A unity feedback control system has an open loop transfer function $G(s) = \frac{K}{s(s^2+4s+3)}$ and sketch the root locus.

b) Determine the stability of a system of the given characteristics equation

$S^4 + 2S^3 + 5S^2 + 16S + 4 = 0$ using R-H criteria.

UNIT - V

9. The state space representation of a system is given below :

$$y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \\ X3 \end{bmatrix} \qquad \begin{bmatrix} X1 \\ X2 \\ X3 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 0 \\ -2 & -5 & 0 \\ 0 & 2 & -3 \end{bmatrix} + \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} u$$

Check for controllability and observability.

(OR)

10. Explain the following :

(i) List out the properties of STM ?

(ii) Write the state equation ?

(iii) Discuss state variable ?

(iv) What is Diagonalize matrix ?

(v) Write the formula for solutions of state equation ?