EE 311 (R-20)

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

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

First Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

LINEAR CONTROL SYSTEMS

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

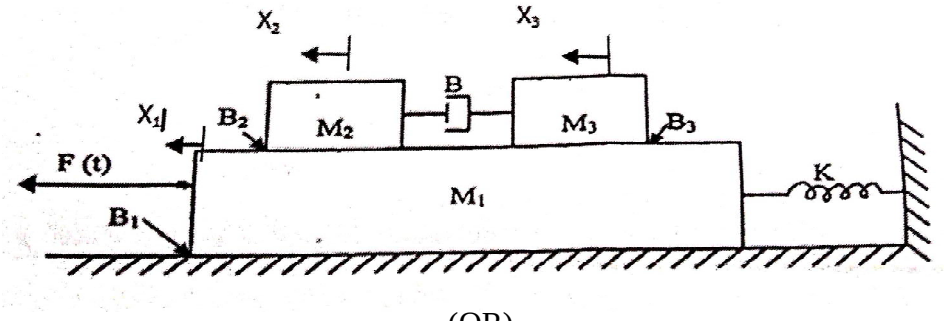
Answer ONE Question from each Unit.

All questions carry equal marks. 5x12=60 M

UNIT - I

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

   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 $\frac{10\,(s+4)}{(s^2\,(s+0.1)\,(s+3))}$.

   b) Give a comparison between open loop and closed loop control systems. Give an example for each.

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.

$$\frac{2k}{s^2\,(s+10)+T}$$

   b) How effect of adding poles and zeros on overshoot, rise time ? Explain.

P.T.O.

(OR)

4. a) Derive an expression for delay time and maximum peak overshoot of an over damped second order system.

   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 ramp input and sketch the response.

UNIT - III

5. The open loop transfer function of system is given by $\frac{12}{s(s+1)(s+5)}$ draw the bode plot and obtain the gain and phase cross over frequencies.

(OR)

6. a) Describe the Nyquist contour and its various segments.

   b) Draw the polar plot of open loop transfer function $\frac{0.5}{(s+7)(s+3)}$ and determine the PM and GM.

UNIT - IV

7. a) Explain briefly about the steps to be followed to construct a root locus plot of a given transfer function.

   b) A unity feedback control system has an open loop transfer function $G(s) = \frac{1.1\ K}{s(s^2+4s+3)}$ and sketch the root locus.

(OR)

8. a) Explain about Lead-Lag compensation ?

   b) Construct R-H criterion and determine the stability of a system representing the characteristics equation $8S^4 + 12S^3 + 2S^2 + 16S + 16 = 0$.

UNIT - V

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

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

Check for controllability and observability.

(OR)

10. a) A discrete time system is described by the difference equation y(k+2) + 5y(k+1) + 6y(k) = u(k), Y(0) = y(1) = 0 and T = 0.5 sec. Determine State transition matrix.

b) Explain about state transition matrix properties.