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

Question Paper Code: 34522

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Fourth Semester

Electronics and Communication Engineering

01UEI422 – LINEAR CONTROL ENGINEERING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

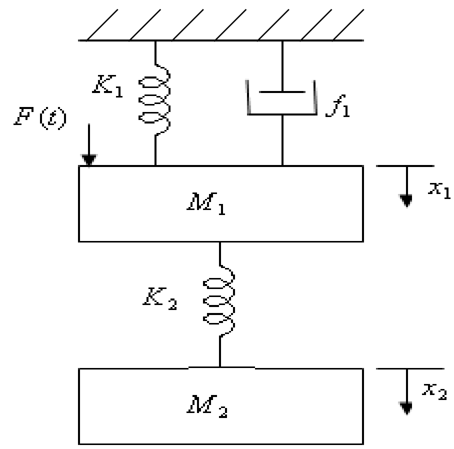
Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What is feedback? What are the components of feedback control system?
2. Write Masons Gain formula.
3. Why derivative controller is not used in control systems?
4. List the time domain specifications.
5. List out the different frequency domain specifications.
6. Define Phase cross over and Gain cross over frequency.
7. State Nyquist stability criterion.
8. Define Relative stability. What is the necessary condition for stability?
9. What are the advantages of State Space analysis?
10. Write the state model.

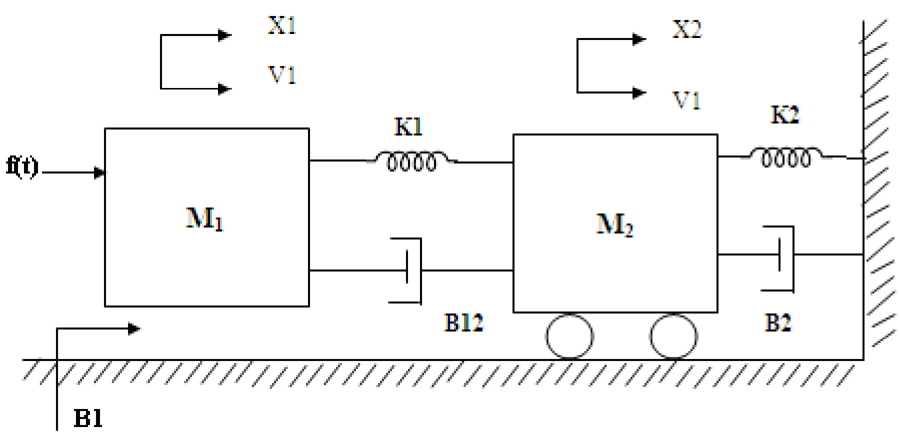
PART - B (5 x 16 = 80 Marks)

11.(a) Write the differential equations governing the behavior of the mechanical system shown in Figure. Also obtain the analogous electrical circuits based on (a) Force-Current analogy (b) Force-Voltage analogy. Also obtain the transfer function $X_1(s)/F(s)$. (16)



Or

(b) Write the differential equations governing the mechanical system shown in Fig. 3. Draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations. (16)



12. (a) (i) Derive and draw the unit ramp response of a first order system. (8)

(ii) Derive and draw the unit step response of a second order system for under damped condition. (8)

Or

(b) For servomechanism with open loop transfer function given below explain what type of input signal give rise to a constant steady error and calculate their value. Given $G(s) = \frac{10}{(s+2)(s+3)}$. (16)

13. (a) Sketch the Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 10 *rad/s*.

$$G(s)H(s) = \frac{Ks^2}{(1+0.25s)(1+0.025s)} \quad (16)$$

Or

(b) (i) Determine the range of values of K for the system to be stable.

$s^3 + 3Ks^2 + (K + 2)s + 4 = 0$ (6)

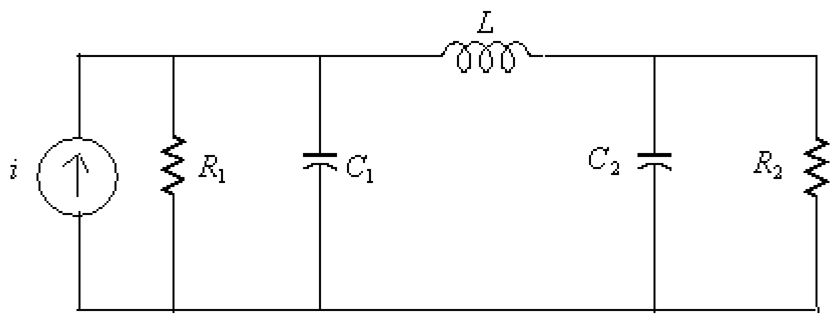
(ii) Check the stability of the following system using Nyquist stability criterion $\frac{10}{(s+1)^3}$ (10)

14. (a) A unity feedback control system has an open loop transfer function $G(s) = \frac{K}{s(s^2 + 4s + 13)}$ .Sketch the root locus. (16)

Or

(b) A certain unity negative feedback control system has the following open loop transfer function $G_H(s) = K / [s(s + 1)(s + 3)]$. Draw the root locus for $0 < k <$ infinity. (16)

15. (a) Obtain the state model of the network shown in Figure-3. Assume $R_1=R_2=1\Omega$, $C_1=C_2=1F$ and $L=1H$. (16)



Or

(b) Determine the State transition matrix for the state model whose A matrix is given by

(i) $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (ii) $A = \begin{bmatrix} 0 & 1 \\ 1 & -2 \end{bmatrix}$. (16)