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

Question Paper Code: 31502

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Electronics and Communication Engineering

01UEI422 – LINEAR CONTROL ENGINEERING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

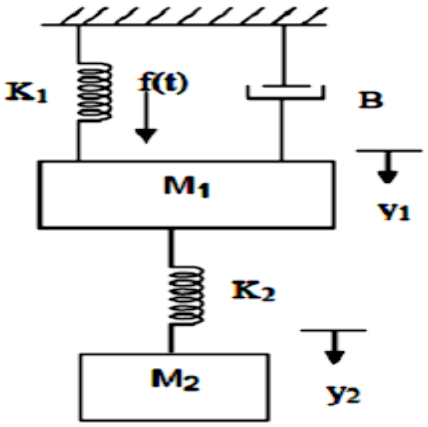
Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What is feedback? What are the components of feedback control system?
2. List the basic properties of signal flow graph.
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. How the roots of characteristic are related to stability?
7. State Nyquist stability criterion.
8. In Routh array what conclusion you can make when there is a row of all zeros?
9. What are the advantages of State Space analysis?
10. State the reason for using state space analysis rather than using transfer function method.

PART - B (5 x 16 = 80 Marks)

11. (a) Write the differential equations governing the mechanical system shown in figure and determine the transfer function. (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)

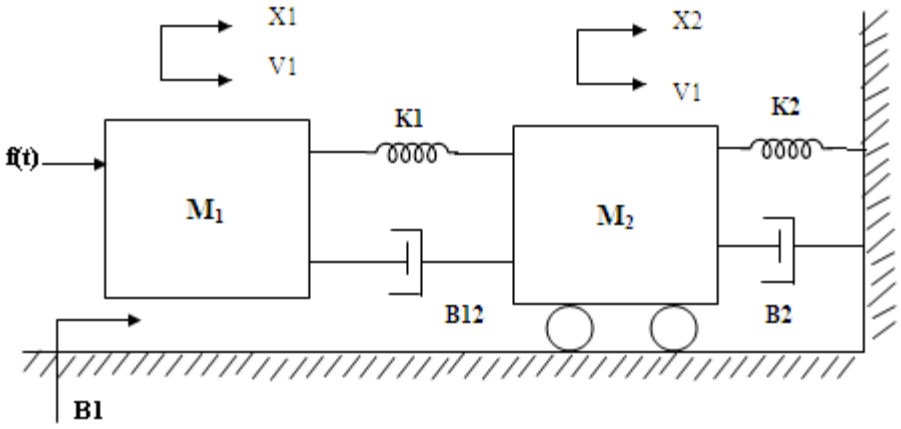


Fig.3

12. (a) Derive the expression for the response of first order system for unit step input. (16)

Or

(b) The open loop transfer function of a servo system with unity feedback system is $G(s) = \frac{10}{s(0.1s+1)}$. Evaluate the static error constants of the system. Obtain the steady state error of the system when subjected to an input given by the polynomial $r(t) = a_0 + a_1 t + a_2 /2\ t^2$ .Also evaluate the dynamic error using the dynamic error coefficients. (16)

13. (a) A unity feedback control system has $G(s) = \frac{K}{s(s+4)(s+10)}$. Draw the Bode plot. Find *K* when phase margin 30^o. (16)

Or

(b) Sketch the Bode plot and hence find gain cross over frequency and phase cross over frequency $G(s) = \frac{10}{s(0.4s+1)(0.1s+1)}$ (16)

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) The open loop transfer function of a system is $G(s) = \frac{K}{s(1+0.1s)(1+s)}$ (16)

(i) Determine the value of *K* so that gain margin is 6 *db*.
(ii) Determine the value of *K* so that phase margin is 40^o.

15. (a) Obtain the state model of the mechanical system shown in Fig. 4 by choosing a minimum of three state variables. (16)

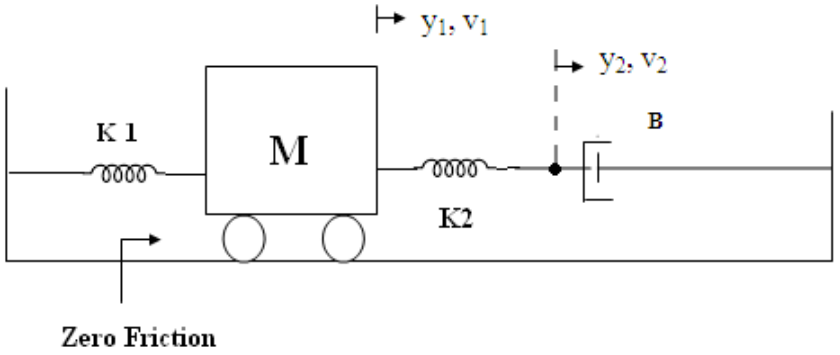


Fig.4

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)