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

Question Paper Code: 41548

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Electronics and Communication Engineering

01UEI422 – LINEAR CONTROL ENGINEERING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

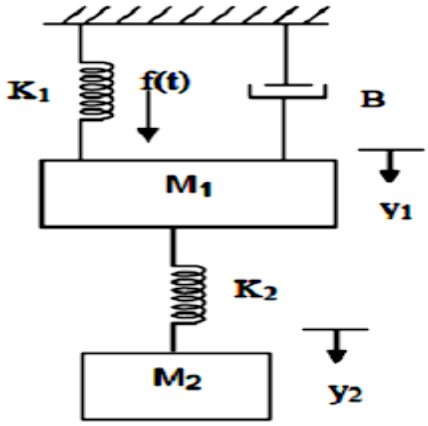
Answer ALL Questions.

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. Define time domain specifications.
5. List out the different frequency domain specifications.
6. Define Phase cross over and Gain cross over frequency.
7. How the roots of characteristic are related to stability?
8. Define Relative stability. What is the necessary condition for stability?
9. What are the advantages of State Space analysis?
10. State the reason for using state space analysis rather than using transfer function method.

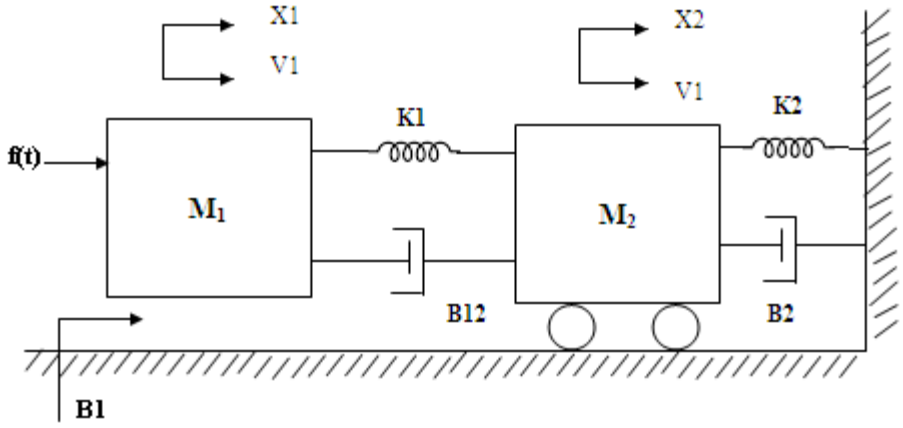
PART - B (5 x 16 = 80 Marks)

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 figure. Draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations. (16)



12. (a) (i) Derive the expression for the response of first order system for unit step input. (8)

(ii) The unity feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{s(s+10)}$. Determine the gain *K*, so that the system will have a damping ratio of 0.5 for this value of *K*. Determine settling time, peak overshoot and time to peak overshoot for a unit step input. (8)

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) (i) 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. (10)

(ii) Write short notes on correlation between time domain and frequency domain specifications. (6)

Or

(b) The open loop transfer function of a unity feedback system is $G(s) = \frac{1}{s(1+s)(1+2s)}$. Sketch the Polar plot and determine the Gain margin and Phase margin. (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) 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)

Or

(b) 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; T=1Sec*. (16)

(i) Determine a state model in canonical form.

(ii) Find the state transition matrix.

(iii) For input *u(k)=1;k ≥ 1*, find the output *y(k)*.