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Question Paper Code: 34522

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Electronics and Communication Engineering

01UEI422 – LINEAR CONTROL ENGINEERING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

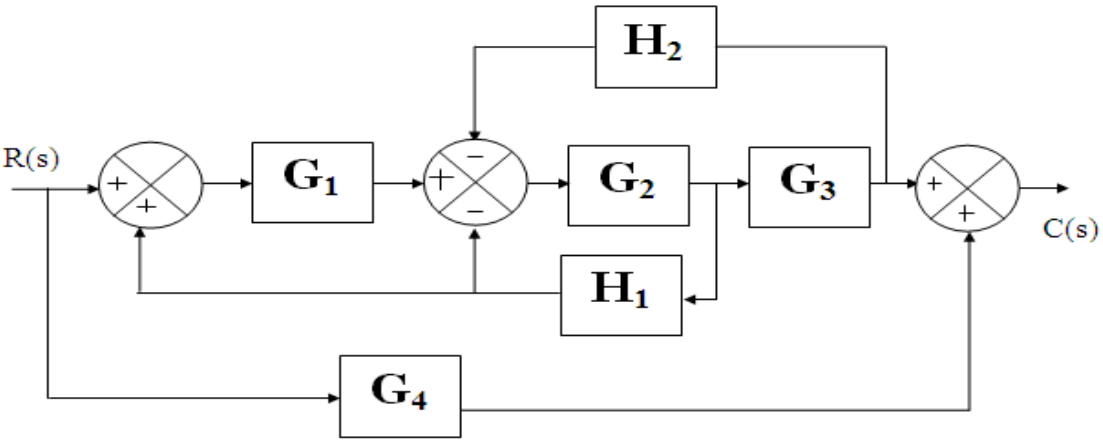
Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What do you mean by an open loop control system?
2. Write Mason's gain formula and its purpose.
3. Why are test signals needed?
4. What is steady state error?
5. List out the different frequency domain specifications.
6. Define Phase cross over and Gain cross over frequency.
7. State Nyquist stability criterion.
8. In Routh array what conclusion you can make when there is a row of all zeros?
9. List the advantages of state space analysis over transfer function approach.
10. Write the state model.

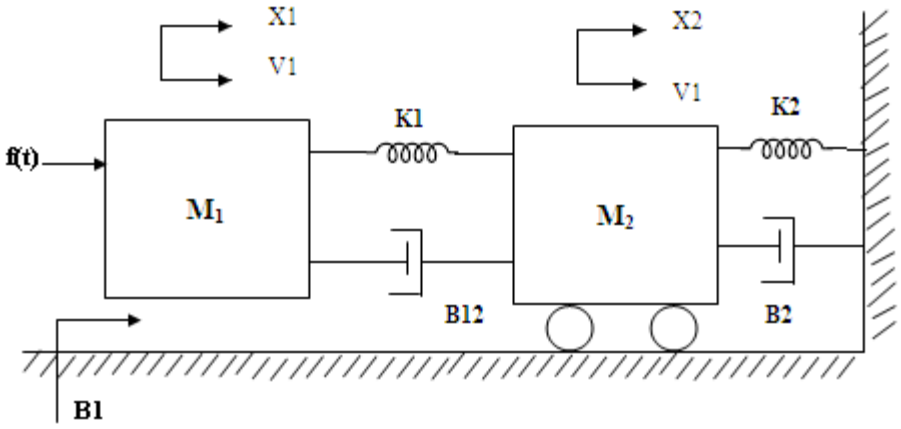
PART - B (5 x 16 = 80 Marks)

11. (a) (i) Obtain the closed loop transfer function *C(S)/R(S)* of the system whose block diagram is shown in Fig. 1. (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) The open loop transfer function of a unity feedback system is *G(s) = 1/s (1 + 0.2s) (1 + 0.02s)* Determine the gain margin and phase margin of the system using bode plot. (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)

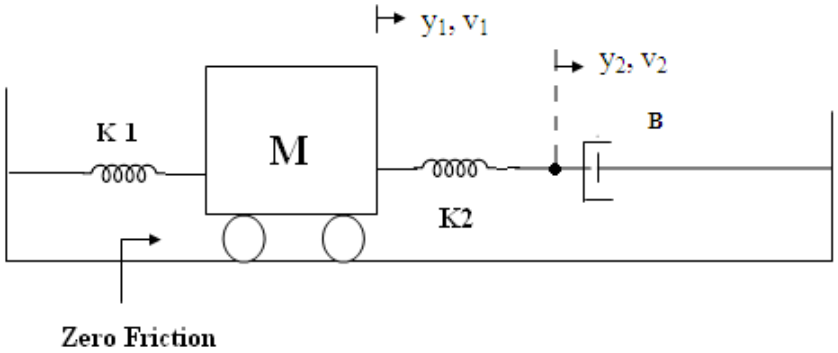
Or

(b) 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)



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)