

Code: 9A02503

B.Tech III Year I Semester (R09) Regular & Supplementary Examinations December 2014

CONTROL SYSTEMS

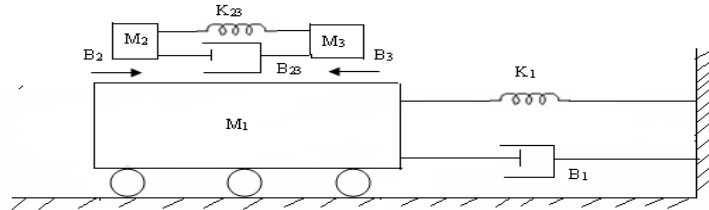
(Common to EEE, E.Con.E, EIE, ECE and MCT)

Time: 3 hours

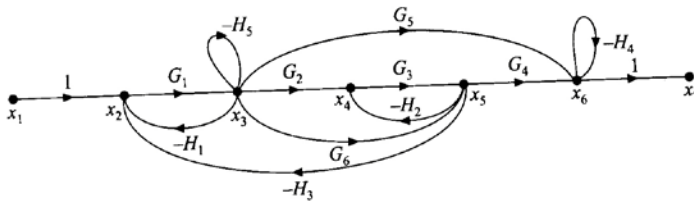
Max Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 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.



- 2 Find the transfer function of the system shown in figure using mason gain formula.



- 3 (a) Derive the expression for rise time, peak time, overshoot and settling time of second order system subjected to a unit step input.
(b) For the servomechanism with open loop transfer function given below, what type of input signal gives rise to a constant steady state error and calculate their values:
 $G(s) = 10/(s + 2)(s + 3)$.

- 4 (a) What are the necessary and sufficient conditions to investigate the stability of the system using Routh- Hurwitz criterion?
b) Factorize the given polynomial using Routh- Hurwitz criterion:
 $F(s) = s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$.

- 5 Sketch the Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec.
 $(s) = K s^2 / [(1+0.2s)(1+0.02s)]$

- 6 Sketch the polar plot for following transfer function and from the plot determine the phase margin and gain margin: $G(s) = [(1 + 0.2s)(1 + 0.025s)] / [s^3(1 + 0.005s)(1 + 0.001s)]$.

- 7 (a) What is compensation? What are the different types of compensators?
(b) What is a lag compensator? Obtain the transfer function of lag compensator and draw pole-zero plot.

- 8 Diagonalize the system matrix. $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -5 & -4 \end{bmatrix}$
