Code: 9A02503

R09

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

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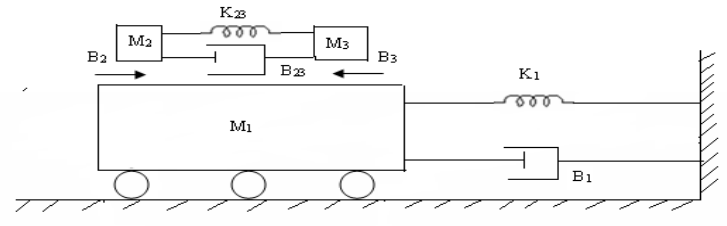
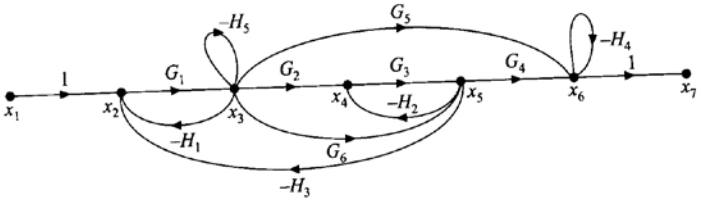
1 Write the differential equations governing the mechanical system shown in figure. Draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations.



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. $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -5 & -4 \end{bmatrix}$

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