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Reg. No. : .....

Name : .....

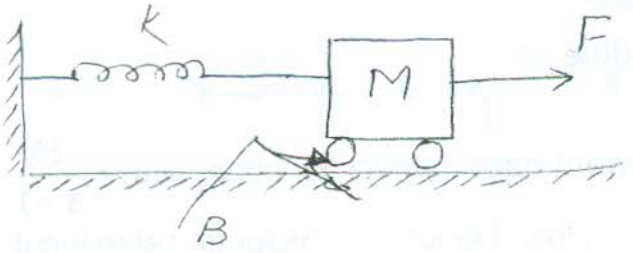
Seventh Semester B.Tech. Degree Examination, October 2014
(2008 Scheme)
08.701 : CONTROL SYSTEMS (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. Define a linear, time-invariant system. Explain superposition theorem which linear systems obey.
2. What are analogous systems ? Find the electric analog of the mechanical system below



3. Obtain the unit step response y(t) of

   1) $G_1(s) = \frac{10}{s+1}$

   2) $G_2(s) = \frac{10}{2s+1}$

   3) $G_3(s) = \frac{10}{5s+1}$

   Explain the significance of time constant.

4. Explain the principle of a DC tachogenerator.

5. Define the terms
   1) absolute stability
   2) relative stability.

6. Distinguish between static and dynamic error constants.
7. A unity feed back control system has an open loop transfer function

$G(s) = \frac{k}{s(s+4)(s^2+8s+32)}$. Make a rough sketch of the root-locus plot of the system.

8. Mention few performance specifications characterizing desired frequency response that are used in the design of linear control systems using Bode plot.
9. What is Nichols chart ? How can we identify resonance peak and bandwidth from Nichol's chart.
10. Discuss the compensation characteristics of cascade lag and lead compensators using Bode plots. **(10×4=40 Marks)**

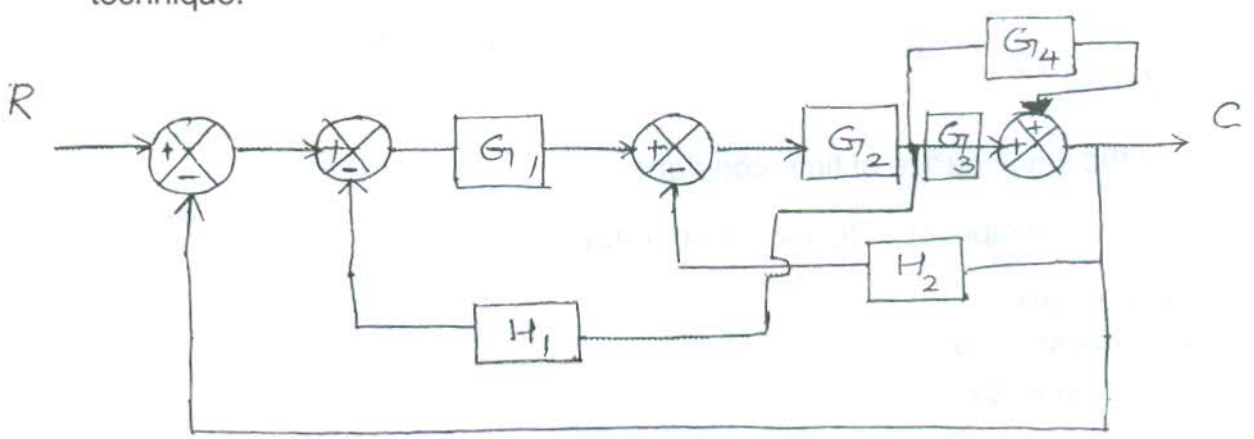
PART – B

Answer **any full** question from **each** Module.

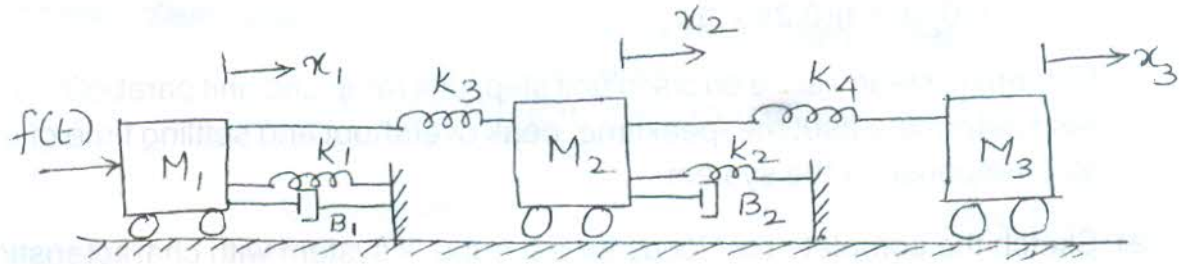
Module – I

11. a) A unity feed back system has forward path transfer function $G(s) = \frac{20}{s+1}$. Determine the response of open and closed loop systems for unit step input. Parameter variations cause G(s) to modify to $G^1(s) = \frac{20}{s+0.4}$. What will be the effect on unit step response of open and closed-loop systems ? Comment on sensitivity of system to parameter variations. 10

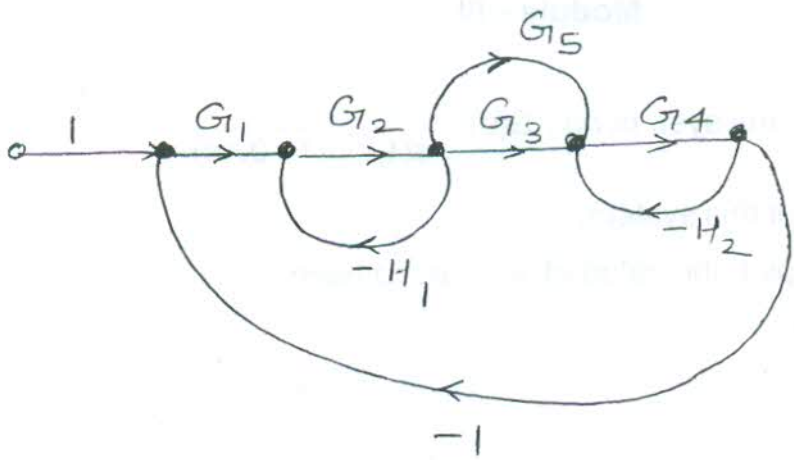
b) Find the overall transfer function of the system using block diagram reduction technique. 10



12. a) Draw the electric analog of the mechanical system given below. **10**

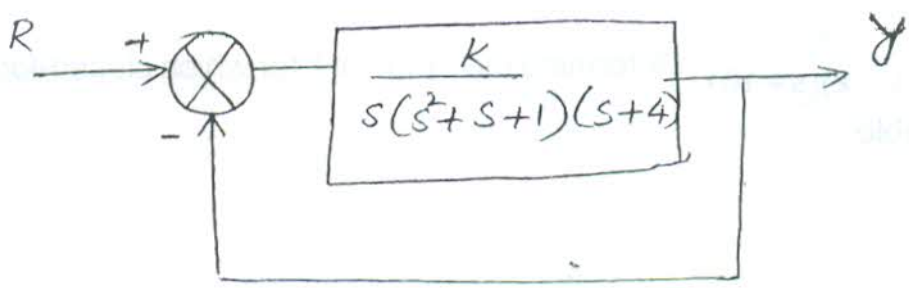


b) Draw the block diagram of the following signal flow graph and find the overall transfer function by block diagram reduction. Verify the result by Mason's gain formula. **10**



Module – II

13. a) Find the range of k for which the system is stable using Routh-Hurwitz criterion. **10**



b) A unity feed back system is characterized by open-loop transfer function

$$G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$$

Determine steady state errors to unit step, unit ramp and unit parabolic inputs. Also determine risetime, peaktime, peak overshoot and settling time of unit step response of the system. 10

14. a) Sketch the complete root locus for a feedback system with characteristic equation $1+\frac{k}{s(s+1)(s+2)} = 0\ ;\ k \geq 0$. 10

b) Explain the relation between time domain and frequency domain specifications. 10

Module – III

15. a) A unity feedback control system has $G(s) = \frac{k}{s(1+s)(1+0.1s)}$

Draw the Bode-plot of this system.

Determine from the plot, the value of 'k' so as to have

Gain Margin = 10 db

Phase Margin = 50°. 12

b) Sketch the polar plot of $G(s) = \frac{1}{s^2(1+sT_1)(1+sT_2)(1+sT_3)}$. 8

16. a) What are the advantages of frequency response analysis ? 8

b) Draw the Nyquist plot for the system whose open-loop transfer function

$G(s)H(s) = \frac{k}{s(s+2)(s+10)}$. Determine the range of k for which closed-loop system is stable. 12