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Reg. No. : .....

Name : .....

Seventh Semester B.Tech. Degree Examination, April 2015

(2008 Scheme)

08.701 – CONTROL SYSTEMS (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **(10×4=40 Marks)**

1. Define node, loop, mixed node and forward path associated with signal flow graph.
2. Compare open loop and closed loop control systems.
3. Explain the principle of operation of gyroscope.
4. Explain Mason's gain formula.
5. What is the effect of adding poles and zeros on root locus ?
6. Explain the standard test signals used for time domain analysis.
7. Define static error constants. Determine the value of error constants for a type I second order system.
8. State and explain Nyquist stability criterion.
9. Derive the transfer function of electrical lead network.
10. Explain the significance of gain margin and phase margin.

P.T.O.

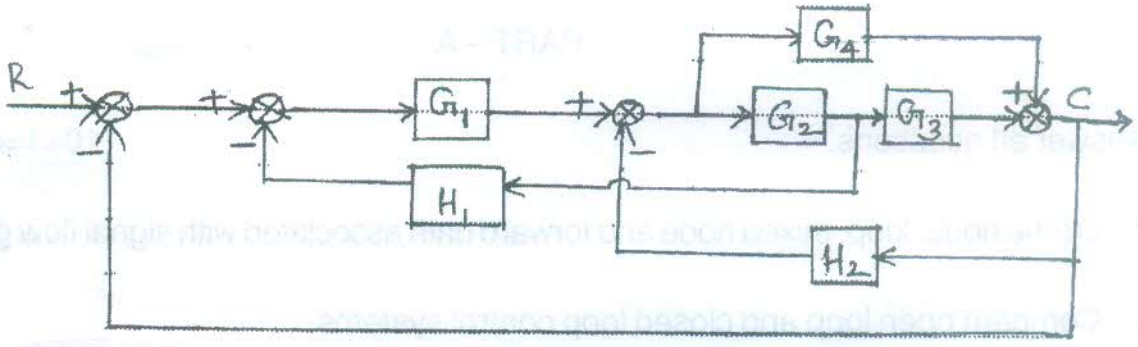
PART – B

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

Module – I

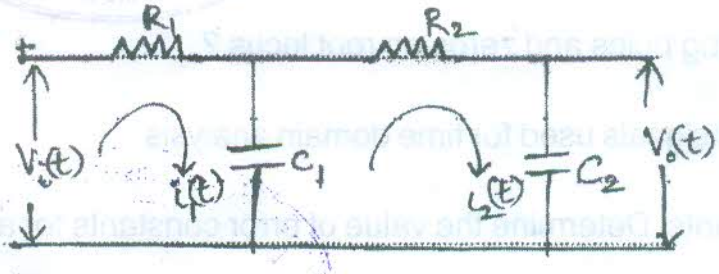
11. a) Derive the transfer function of an armature controlled d.c. motor. 8

b) Determine the transfer function $\frac{C(s)}{R(s)}$ by applying block, diagram reduction technique. 12

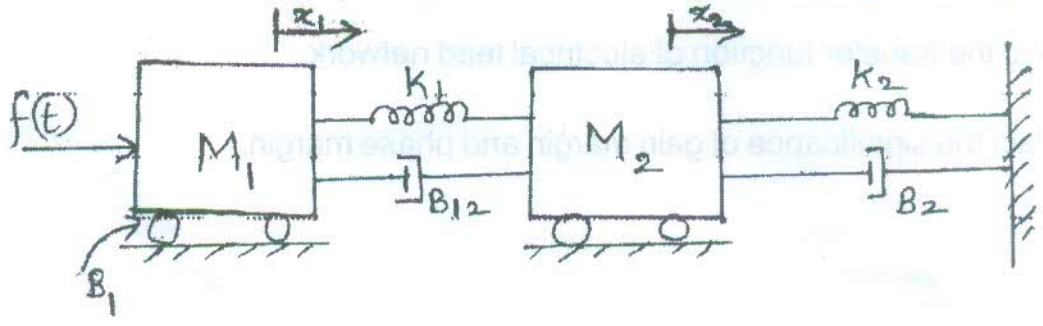


OR

12. a) Find $\frac{V_o(s)}{V_i(s)}$. 8



b) Write the differential equations governing the mechanical system shown. Draw the force voltage analogous circuit and verify by writing mesh equations. 12



Module – II

13. a) Determine the stability of the system whose characteristic equation is $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$ using Routh's stability criteria. 8

b) The closed loop transfer function of a unity feedback system is given by $G(s) = \frac{K}{s(s+10)}$. Determine the gain k so that the system would have a damping ratio of 0.5. For this value of K, determine settling time, peak time, delay time, peak overshoot and time for peak overshoot for unit step input. 12

OR

14. For a unity feedback system, open loop transfer function is given by

$$G(s) = \frac{K}{s(s+2)(s^2+6s+25)}$$

a) Sketch the root locus for $0 < k < \infty$.

b) At what value of K, the system becomes unstable ?

c) At this point of instability determine the frequency of oscillation of the system.

d) Find k such that the system has a damping factor of 0.707. 20

Module – III

15. a) Determine the stability of the closed loop unity feedback system using Nyquist stability criterion for the system whose open loop transfer function is

$$G(s) = \frac{1}{s^2(1+s)(1+2s)}.$$ 15

b) Sketch polar plot of $G(s) = \frac{1}{(1+sT_1)(1+sT_2)}$. 5

OR

16. a) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{10(s+3)}{s(s+2)(s^2+4s+100)}$. Draw Bode plot and find the gain margin and phase margin. 15

b) Explain minimum phase and nonminimum phase systems. 5