Name : .....

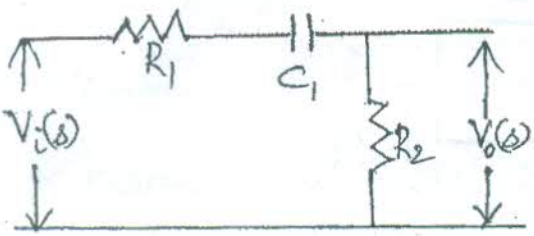
Seventh Semester B.Tech. Degree Examination, November 2015
(2008 Scheme)
08.701 : CONTROL SYSTEMS (E)

Time : 3 Hours Max. Marks : 100

PART – A

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

1. Define transfer function. What are the properties of transfer function ?
2. Explain force voltage analogy with example.
3. Explain the operation of DC servomotor.
4. Find the transfer function :



5. Explain rise time, peak time and peak overshoot of a second order under-damped system subjected to step input.
6. Differentiate between type and order of a system with example.
7. Find the value of k for which the unity feedback system $G(s) = \frac{k}{s(s+2)(s+4)}$ cross the imaginary axis.
8. Derive the transfer function of electrical lag network.
9. Explain minimum and non-minimum phase system.
10. Define resonant peak, resonant frequency and bandwidth of a system.

P.T.O.

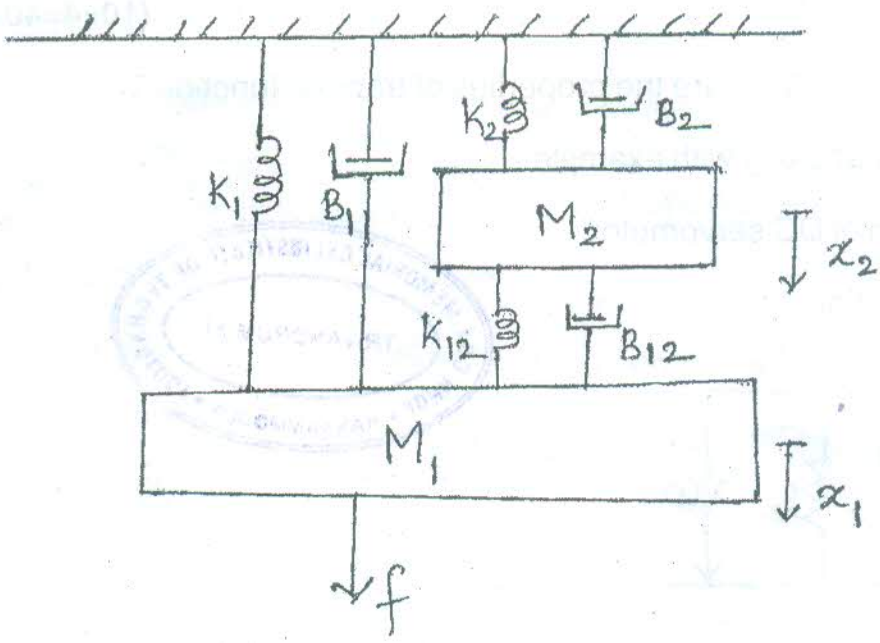
PART – B

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

Module – 1

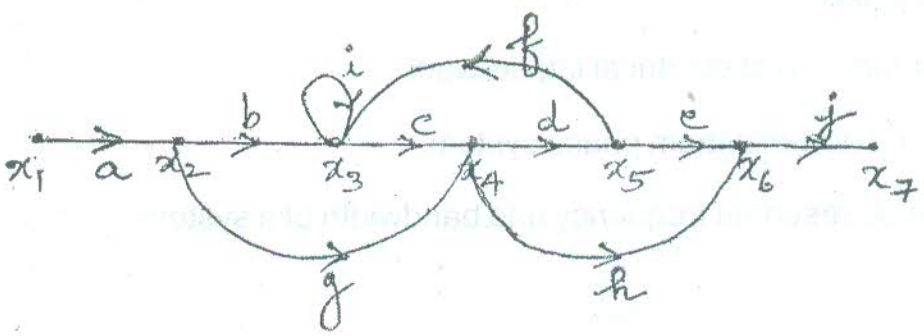
11. a) Derive the transfer function of a field controlled DC servomotor. **5**

b) Derive the system equations for the mechanical system shown below. Also find the analogous electrical systems. **15**

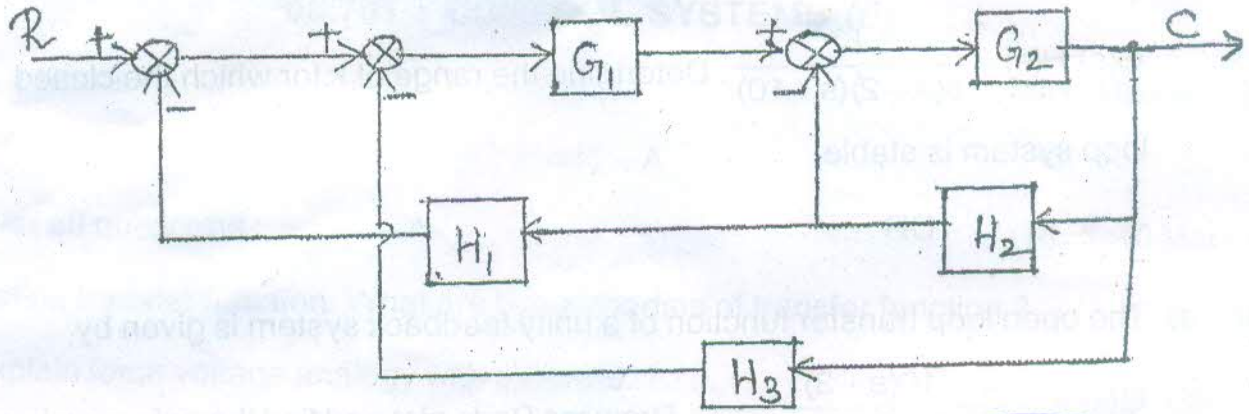


OR

12. a) Find $\frac{X_7}{X_1}$ using Mason's gain formula. **10**



b) Find $\frac{C}{R}$ using block diagram reduction technique. 10



Module – 2

13. a) Derive the expression for step response of a second order system. 12

b) Examine the stability of $s^5 + 2s^4 + 4s^3 + 8s^2 + 3s + 1 = 0$ using Routh's criteria. 8

OR

14. a) A unity feedback control system has an open loop transfer function

$$G(s) = \frac{k}{s(s^2 + 8s + 17)}.$$

Sketch the root locus of the system. Find the value of k so that the system has a damping factor of 0.5 and for this value of k, find the roots of the characteristic equation. 15

b) Define static error constants. Determine the value of error constants for a type 1 second order system. 5

Module – 3

15. a) State and explain Nyquist stability criterion. 5

b) Draw the Nyquist plot for the system whose open loop transfer function is $G(s)\,H(s) = \frac{K}{s(s+2)(s+10)}$. Determine the range of k for which the closed loop system is stable. 15

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 the Bode plot and find the gain margin and phase margin. 15

b) Sketch the polar plot of a type 1, second order system. 5