

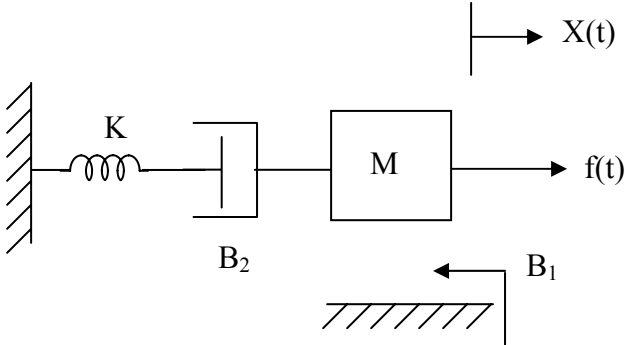
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III.B.TECH - I SEMESTER REGULAR EXAMINATIONS NOVEMBER, 2009
CONTROL SYSTEMS
(Common to EIE, AE)

Time: 3hours

Max.Marks:80

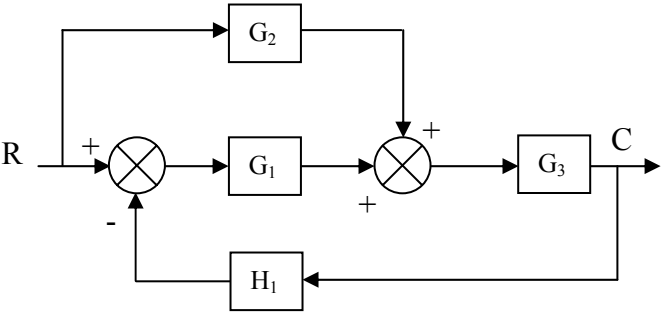
Answer any FIVE questions
All questions carry equal marks

1.a) Draw the force-voltage analogous circuit for the system given below.



- b) Give the difference between order and type of a system.
- c) Explain the concept of control system with suitable example. [5+5+6]

2.a) Determine the transfer function $\frac{C(s)}{R(s)}$ for the following block diagram



- b) Explain the properties of signal flow graphs. [8+8]

3.a) A unity feedback system has forward path transfer function

$$G(s) = \frac{20}{(s+1)}$$

Determine and compare the response of open-loop and closed-loop systems for a unit step input.

b) For a negative feedback control system having forward path transfer function:

$$G(s) = \frac{k}{s(s+6)} \text{ and } H(s) = 1$$

Determine the value of gain k for the system to have damping ratio of 0.8. For this value of gain k, determine the complete time response specifications. [8+8]

4.a) Investigate the stability of a control system whose characteristic equation is given by:

$$s^4 + 3s^3 + 5s^2 + 2s + 10 = 0$$

b) Explain the steps followed for construction of Root locus by taking an example. [8+8]

5.a) Bandwidth is directly proportional to ω_n . Justify.

b) The forward path transfer function of a unity feed back system is

$$G(s) = \frac{K}{s(s+6.54)}. \text{ Find the resonant peak, resonant frequency \& Bandwidth of closed}$$

loop system for

i. $K = 5$

ii. $K = 21.39$

iii. $K = 100.$

Comment on the result. [6+10]

6.a) Explain frequency domain specifications.

b) Determine gain margin and phase margin of a system, whose transfer function is

$$\text{given by } G(s) = \frac{3000}{s(s+10)(s+100)}. \quad [8+8]$$

7. For the unity feed back control system forward path transfer function

$$G(S) = \frac{K}{s(s+4)(s+20)}. \text{ Design a lag-lead compensator so that } PM \geq 40 \text{ and steady state}$$

error for unit ramp input ≤ 0.04 rad. [16]

8.a) Discuss the significance of State Space Analysis?

b) Define state variables.

c) Obtain the state variable representation of an armature controlled D.C motor?

[4+4+8]
