

Time (3 Hours)

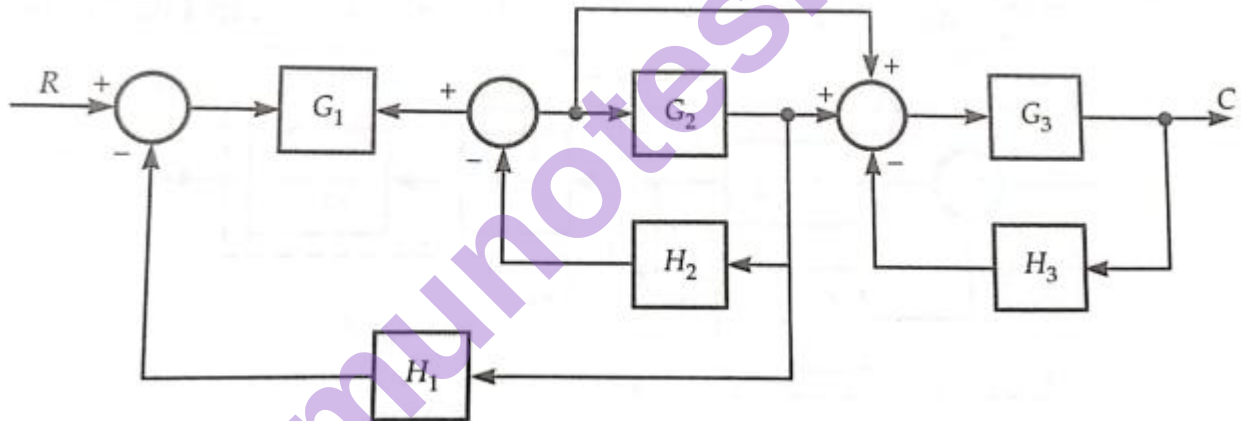
80 Marks

- Note: (1) Question no. 1 compulsory
 (2) Attempt any 3 question out of remaining five questions.
 (3) Draw neat diagram wherever necessary.

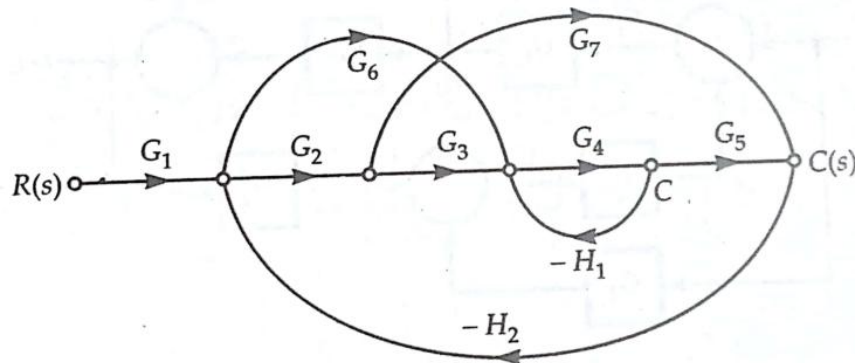
Q 1. Attempt any Four out of five questions

- Consider an open loop system, $G(s)H(s) = \frac{k}{s^3 + 4s^2 + 8s}$. Check whether $s = -1.33 + j 0.94$ point lies on the root locus or not using angle condition in root locus.
- Explain the stability conditions of Bode plot by using suitable diagrams.
- Explain the general representation of state space model with example.
- Explain the term damping ratio. Also explain the conditions for the damping ratio.
- Explain force current analogy in mathematical modeling of control system.

Q 2. a. Obtain the transfer function for the following figure using Block Diagram Reduction method.

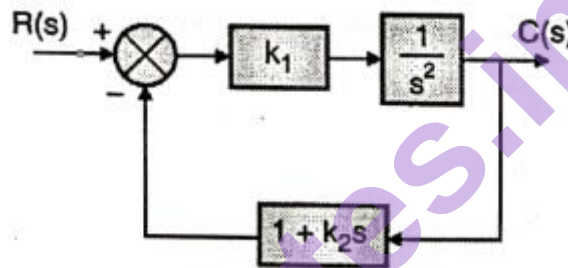


- Obtain the transfer function $C(s)/R(s)$ for the following figure using Mason's gain formula.



- Q3. a. Given the unity feedback system that has the forward transfer function $G(s) = \frac{k(s+2)}{s(s^2+4s+13)}$. Sketch the complete root locus.
- b. Determine the stability of a system having the characteristics equation using Routh-Hurwitz criteria: $s^6 + 5s^5 + 11s^4 + 25s^3 + 36s^2 + 30s + 36 = 0$ find the stability of the system using Routh Hurwitz criteria.

- Q4. a. A feedback control system has $G(s) H(s) = \frac{k}{s(s+2)(s+10)}$ Draw Bode plot and comment on stability.
- b. For a control system, find the values of K_1 and K_2 so that $M_p = 25\%$ and $T_p = 4$ sec. Assume step input. Also find (1) Settling time (2) Rise time.



- Q5. a. Explain the closed loop system. Also, compare the open loop and closed loop system for any control system.
- b. Represent the following state space equation in phase variable form and also draw its state model $\frac{C(s)}{R(s)} = \frac{20(s+1)(s+3)}{(s+1)(s+5)(s+7)}$
- Q6 a. The control system having unity feedback has $G(s) = \frac{20}{s(1+4s)(1+s)}$. Determine:
 (1) Type of system. (2) Static error constants. (3) Steady state error for the input $r(t) = 2 + 4t + \frac{t^2}{2}$
- b. Explain armature controlled DC servomotor and also draw the block diagram.
