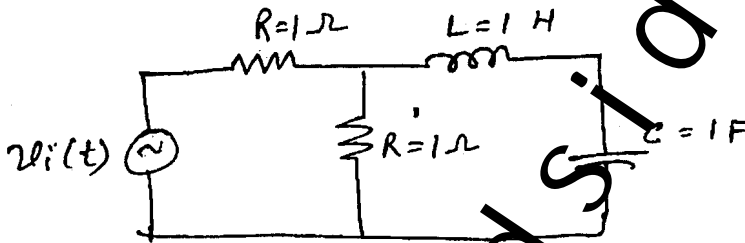


- N.B. :** (1) Question No. 1 is compulsory.
 (2) Answer any four out of remaining six questions.
 (3) **Figures** to the right indicate full marks.
 (4) **Illustrate** answers with **sketches** wherever required.

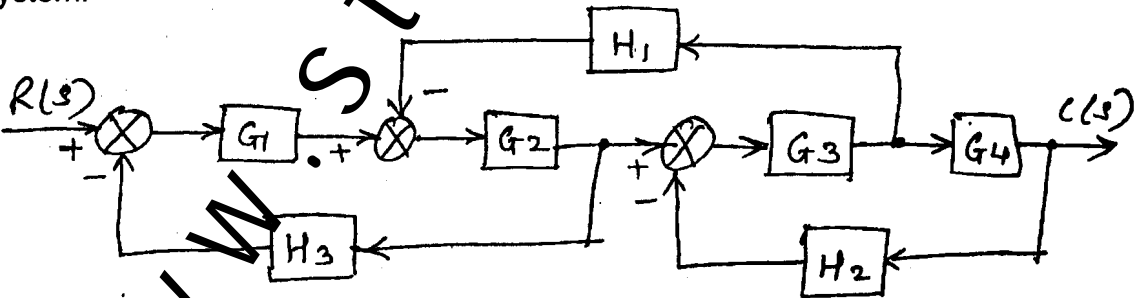
1. (a) Explain the relationship between poles and system dynamic response. 5
 (b) Define sensitivity. How can we reduce sensitivity of closed loop system? 5
 (c) Compare the two stability methods : 5
 (i) Root-locus (ii) Routh's criterion.
 (d) Give advantages of Nyquist plot. 5
2. (a) For the given electrical system 10



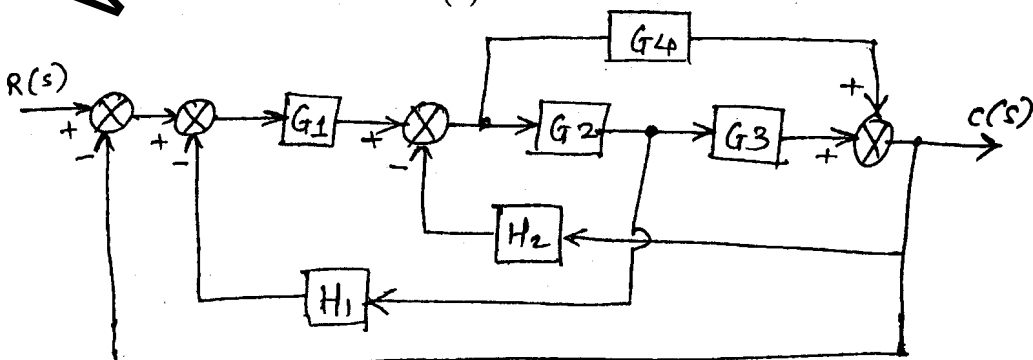
Determine :-

- (i) Transfer function model
 (ii) State variable model.

- (b) Explain the effect of an additional zero and additional pole to the standard second order system. 10
3. (a) Using block diagram reduction method obtain the transfer function of the given system. 10



- (b) Consider the following block diagram shown. Draw its equivalent signal flowgraph and find the transfer function $\frac{C(s)}{R(s)}$ using Mason's Gain Rule. 10



4. (a) Derive and analyse the response of a second order system to unit step input. With the help of graphical plots explain the significance of damping ratio for its various values. 10
- (b) Derive steady-state errors for various standard inputs. Explain the relation between steady-state error and TYPE of the system. 10

5. (a) Using Routh's stability criterion :- 10
- (i) Find range of K for stability of given system and frequency of oscillations.
 $s^4 + 9s^3 + 26s^2 + 24s + K = 0$
- (ii) Determine the number of roots on the imaginary axis for
 $s^5 + 6s^4 + 15s^3 + 30s^2 + 44s + 24 = 0$.

- (b) Determine the value of K for unity feedback control system whose open loop transfer function is given as, 10

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}$$

- (i) Phase Margin = 60°
 (ii) Gain Margin = 20 db.

6. (a) The open-loop transfer function of a feedback system is 10

$$G(s)H(s) = \frac{K}{s(s+6)(s^2+4s+13)}$$

Draw the complete root locus.

- (b) Draw Bode plot for. 10

$$G(s)H(s) = \frac{4}{s(s^2+16s+4)}$$

Obtain gain crossover frequency, phase crossover frequency, gain margin and phase margin.

Also comment on stability of the system.

7. Write short note on (any two) :- 20

- (a) Error compensation technique and their effects on system performance.
 (b) Armature controlled dc servomotor.
 (c) Stepper motor construction and use in control systems.