[CH-1] [SIGNAL FLOW GRAPH]

[SHORT QUESTIONS] [2 MARKS]

Q-1) (a) Define signal flow graph.

(b) What is Mason's gain formula?

(c) Define loop, self loop, path gain, loop gain for SFG.

(d) Name the major parts of a closed loop control system.

(e) Define open loop & closed loop control system.

(f) Define transfer function.

(g) Define characteristic equation of a transfer function.

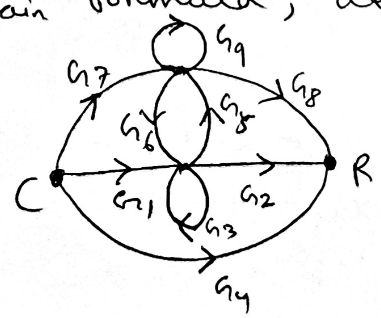
(h) State the rule for shifting the summing point ahead of a block.

Q-2 [LONG QUESTIONS]

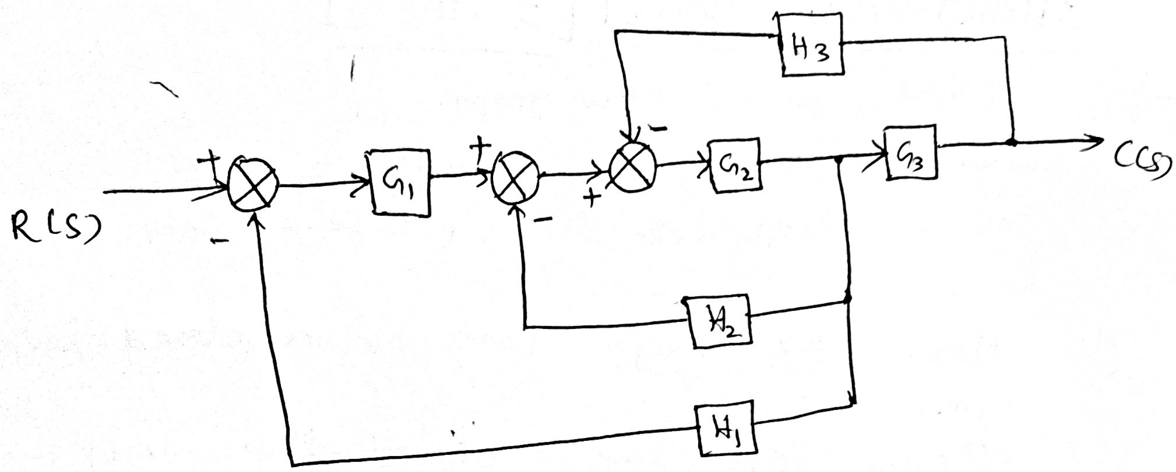
(a) Write down the basic properties of a signal flow graph.

(b) Write down the rules for construction of a signal flow graph.

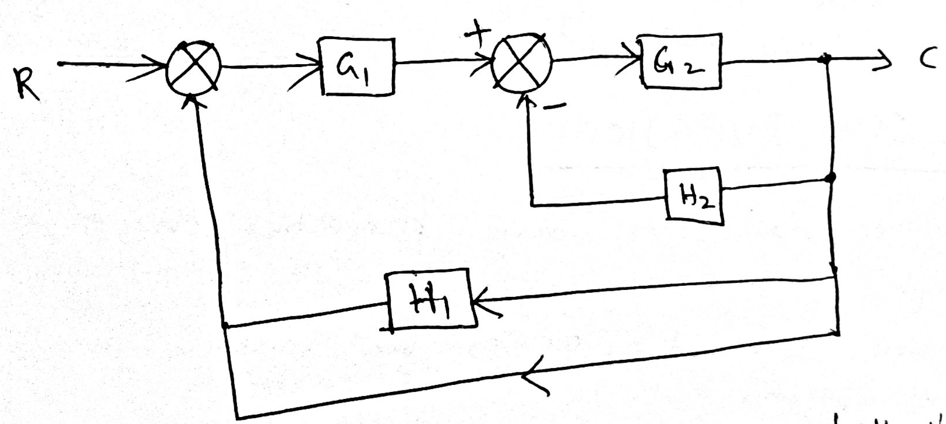
(c) Using Mason's gain formula, determine the ratio C/R.



(d) Findout the transfer function by block reduction method.



(e) Determine the transfer function of the given system.



(f) Draw the signal flow graph for the following equations.

i) $x_2 + 5x_3 - 2x_4 = 0$

ii) $x_3 + 2x_4 - 4x_2 = 0$

iii) $x_4 - 8x_3 = 0$

[Ch-2] [TIME RESPONSE ANALYSIS]

Q-1 [SHORT QUESTIONS] [2 MARKS]

(a) Define transient response.

(b) Sketch various test input signals for transient analysis.

(c) Write mathematical expressions for various test ~~Signa~~ input signals.

(d) Define delay time, rise time & peak time.

(e) What is steady state error?

(f) What is the effect of feedback on time constant of a control system?

(g) State how type & order of a control system is determined?

(h) What are static error coefficient?

(i) Define K_p, K_v & K_a.

(j) Define damping ratio.

(k) Define time domain specifications?

Q-2 [LONG QUESTIONS]

(a) Derive the response of first order system with
(i) Unit step input &
(ii) Unit impulse input.

(b) A unity feedback system is characterise by an open loop transfer function,

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

Determine the gain 'K' so that the system will have a damping ratio of 0.6. For this value of 'K', calculate settling time, peak ~~time~~ overshoot & time to peak overshoot for a unit step input.

(c) The open loop transfer function of a servo system with unity feedback system is given by,

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

Determine the damping ratio, undamped natural frequency, maximum overshoot for unit step input with K = 10

(d) Find the steady state error for an input of a unity feedback system as,

$$R(t) = 1 + t + \frac{t^2}{2}.$$

(e) For a system having transfer function,

$$\frac{C(s)}{R(s)} = \frac{64}{s^2+5s+64}.$$

Determine (i) ω_n (ii) ξ (iii) ω_d.

(f) The open loop transfer function of unity feedback system is given by,

$$G(s) = \frac{100}{(1+0.1s)(s+10)}.$$

Determine K_p, K_v & K_a.

(g) Find the dynamic error coefficients of the unity feedback system whose forward path transfer function $G(s) = \frac{10}{s(s+1)}$.

Find the steady state error to the input,

$$R(t) = P_0 + P_1 t + P_2 t^2.$$

(h) Obtain the unit step response of a unity feedback system whose open loop transfer function is,

$$G(s) = \frac{4}{s(s+5)}$$

(i) A system having a forward path transfer function $G(s) = \frac{16}{s(s+1)}$, & unity feedback. Determine the value of undamped natural frequency, damping ratio. If tachometer feedback is introduced, the feedback path transfer function becomes (1+KS). What should be the value of 'K' to obtain damping ratio of 0.6. Also calculate the percentage peak overshoot, first undershoot, t_p & settling time within the 2% of final value.

(j) Consider the system as shown in figure below. Determine the value of 'a' such that the damping ratio is 0.5. Also obtain the values of rise time, maximum overshoot 'M_p' in its step response.