

Duration 3 Hours

[Maximum Marks 80]

NOTE: 1) Question 1 is **compulsory**

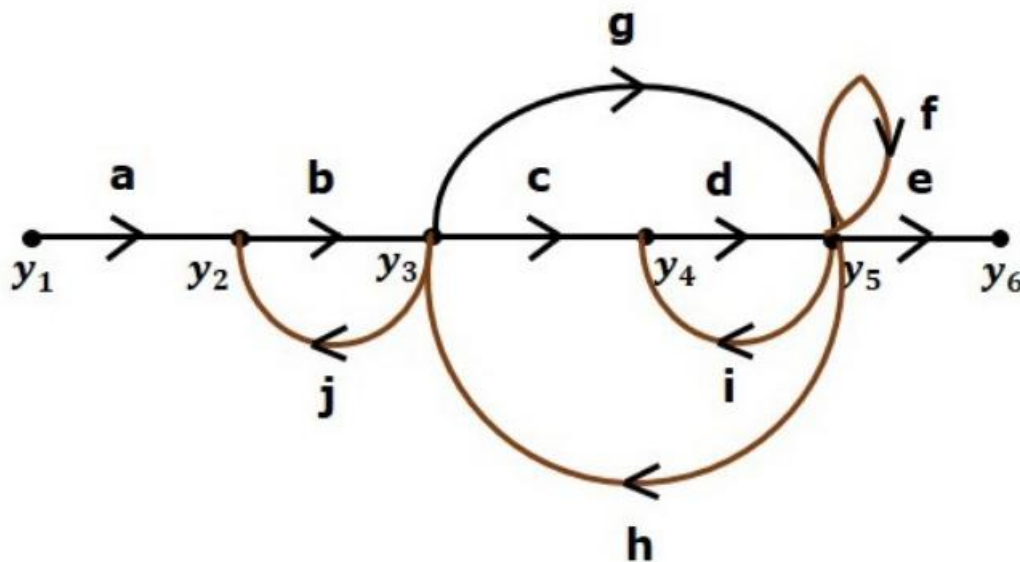
2) Solve **any three** from the remaining five questions

3) Assume suitable data if necessary.

4) Figures to the right indicate full marks

- Q.1. a.** Explain the terminologies associated with signal flow graphs 5
b. Explain frequency domain specifications of second order control system. 5
c. Explain the concept of relative stability 5
d. Explain is Routh Hurwitz criterion 5

- Q.2. a.** Find the transfer function of the signal flow graph shown in figure by using 10
 Mason's Gain formula.



- b.** Find the stability of the control system having characteristic equation 10

$$S^4 + 2S^3 + S^2 + 2S + 1 = 0$$

- Q3. a.** A unity feedback control system has a loop transfer function 10

$$G(s) = \frac{10}{s(s+2)}$$

Find the rise time, percentage overshoot, peak time and settling time for a unit step input.

- b.** Draw Nyquist plot of $G(s) H(s) = \frac{90}{(s+3)(s+6)}$ 10

Q.4.a. Draw the Root locus diagram for the system and comment on stability. **10**

$$G(s) H(s) = \frac{K(s+1)}{s(s+2)(s+3)}$$

b. List the steps involved in design of lead compensator using Bode plot. **10**

Q.5. a. Draw the Bode plot for the given open loop transfer function and test the stability. **10**

$$G(s) H(s) = \frac{2000(s+0.5)}{s(s+10)(s+50)}$$

b. Obtain the state model for the system with transfer function. **10**

$$\frac{Y(s)}{U(s)} = \frac{1}{s^2 + s + 1}$$

Q.6. Short note on (Any Two) **20**

- a.** Block Diagram Reduction Rules
- b.** Time domain specifications of Second order system
- c.** Concept of Observability
