

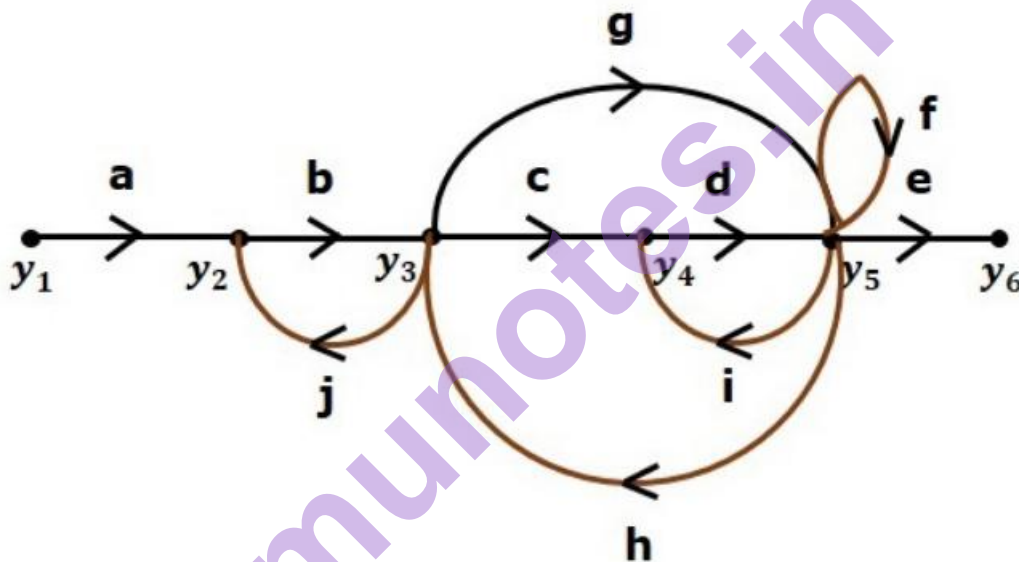
Duration 3 Hours

[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

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