

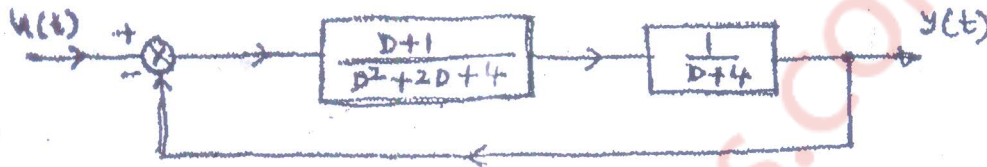
(3 Hours)

[Total Marks : 80

- N.B. : (1) Attempt any four questions.
 (2) Figures to the right indicate full marks.
 (3) Assume suitable data if necessary.

1. (a) Derive the state-space equation for following system :

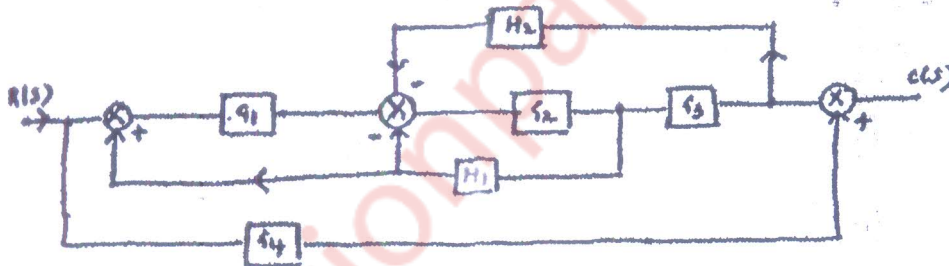
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- (b) Explain the working of Servo Motor and Stepper Motor. 06
 (c) Discuss the use of Nyquist plot in stability. 04

2. (a) By Block reduction method, find the transfer function :

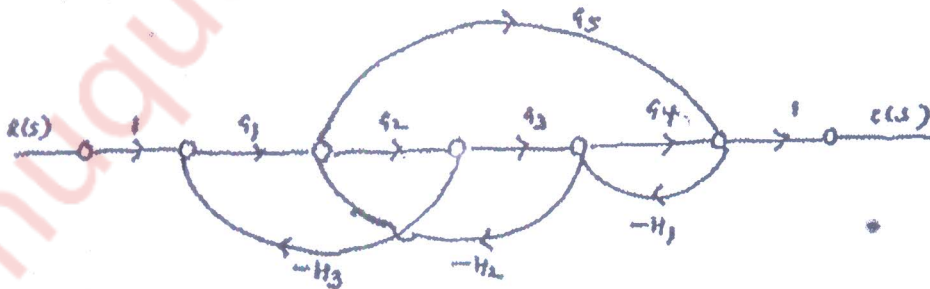
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(b) For the S. F. G. (Signal Flow Graph) shown below.

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Obtain $\frac{C(s)}{R(s)}$.



TURN OVER

3. (a) For the unity feedback system having OLTF, 10

$$G(s) = \frac{k(s+2)}{s(s^3 + 7s^2 + 12s)}$$

Find following :

- (i) Type of the system.
(ii) Error coefficients.

(iii) Steady state error when input to the system is $\frac{R}{2}t^2$.

- (b) Derive transfer function for spring mass damping system. 10

4. (a) Find the range of value 'k' so that system with following C. E. (Characteristic Equation) is stable : $F(s) = s(s^2 + s + 1)(s + 4) + k = 0$. 05

- (b) A second order system is given by : 10

$$\frac{C(s)}{R(s)} = \frac{25}{s^2 + 6s + 25}$$

Find its rise time, peak time, peak overshoot and setting time, if subjected to unit step input. Also calculate expression for its output response.

- (c) Discuss Low Cost Automation. 05

5. (a) A unity feedback control system has :

$$G(s) = \frac{100}{s(s+0.5)(s+10)}$$

Draw the asymptotic Bode plot. Determine G.M., P.M., Wgc and Wpc. Comment on the stability.

- (b) For the system with T.F. $\frac{Y(s)}{V(s)} = \frac{s^2 + 2s + 1}{s^3 + 7s^2 + 14s + 8}$ derive the state-space representation. 10

6. (a) Sketch the Root Locus for $G(s)H(s) = \frac{k(s+4)}{s(s+1)(s^2+5s+12)}$ 10

- (b) Write short notes on :

- (i) Mathematical Modeling for R-L-C.
(ii) Synchronos. 10