

[Time: 3 Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Attempt any four questions.
 2. Assume suitable data, if required with justification.

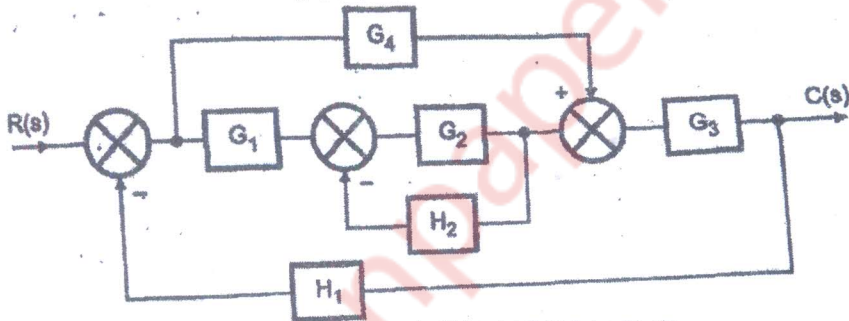
Q.1 a) Determine the stability of the given characteristics equation by Hurwitz's method 05

$$S^3 - 4S^2 + S + 6 = 0$$

b) Is the following system stable? 05

$$S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$$

c) Obtain transfer function of the feedback control system shown in fig by block diagram reduction technique 10



Q.2 a) For unity feedback system 12

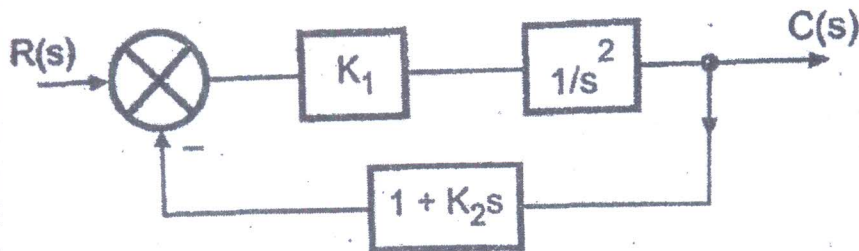
$$G(S) = \frac{K}{S(S+2)(S+10)}$$

Determine marginal value of 'K' for which system will be marginally stable.

b) Write a short note on 08

- (i) Non-Linear System
- (ii) Open Loop and Closed Control system

Q.3 a) For a control system shown in figure, find the value of K_1 and K_2 so that $M_p = 25\%$ and $T_p = 4$ sec. Assume unit step input 10



- b) What is mathematical modeling? Explain with suitable example. Also state the advantages and Limitation of the mathematical models. 10

Q.4 a) Sketch the root locus for the system having 14

$$G(S)H(S) = \frac{K(s + 0.5)}{S(S^2 + 2S + 2)}$$

Also Determine 'K' for damping ratio of 0.5 from the root locus.

- b) Test the Observability of the system described by 06

$$A = \begin{bmatrix} -2 & 0 \\ 0 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 3 \\ 1 \end{bmatrix} \quad C = [1 \quad 0]$$

Q.5 a) For unity feedback system having 16

$$G(S) = \frac{10(S + 1)}{S^2(S + 2)(S + 10)}$$

Determine

- i) Type of system
- ii) Error of coefficient and
- iii) Steady state error for input as $1 + 4t + \frac{t^2}{2}$

b) Explain PID Controller 05

c) What are lead, lag, lag-lead compensators? When it is preferred? 05

Q.6 a) Write a short note on (Solve any two) 10

- (i) Stepper motor
- (ii) Synchros
- (iii) Servo motor

b) Obtain state model of the system describe by transfer function 10

$$\frac{y(s)}{u(s)} = \frac{8}{s^3 + 6s + 7}$$
