

[Time: Three Hours]

[Marks:80]

**N.B.: (1) Question No.1 is compulsory.****(2) Attempt any three out of remaining questions.****(3) Assume suitable data wherever required.**

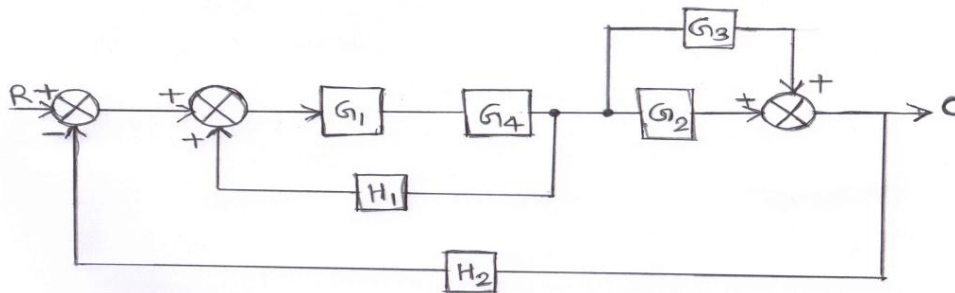
Q.1. Attempt the following

(20)

- Differentiate between Open Loop and Closed Loop Control System.
- Define the terms (i) Zero input response (ii) Zero state response.
- Define Absolute, Relative and Robust Stability of the System.
- What are the drawbacks of transfer function model?

Q.2 a. Find the transfer function  $C(S)/R(S)$  of the system Shown in the figure below.

(10)



b. Sketch the root locus for the below given System.

(10)

$$G(S)H(S) = \frac{K}{s(s+3)(s+5)}$$

Q. 3 a. Obtain the State Variable model of the transfer function given below.

(10)

$$T(S) = \frac{s^2 + 3s + 3}{s^3 + 2s^2 + 3s + 1}$$

b. Explain Controllability and Observability analysis of LTI System using Suitable example.

(10)

Q.4 a. Use the Routh Stability Criteria to determine the range of 'K' for stability of unity feedback system whose Open Loop transfer function is given below.

(10)

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

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b. If (10)

$$G(s)H(s) = \frac{K(s+1)}{s^2(s+2)(s+4)}$$

Using Polar Plot determine the range of 'K' for stability. Verify result by Rouths Criteria.

Q.5 a. Draw the Bode diagram for the transfer function (10)

$$G(s) = \frac{64(s+2)}{s(s+0.5)(s^2+3.2s+64)}$$

Determine  $G_m$ ,  $P_m$ ,  $W_{gc}$  and  $W_{pc}$ . Comment on the Stability.

b. For the given transfer function find  $T_p$ , % MP,  $T_s$ , and  $T_r$ . (10)

$$G(s) = \frac{100}{(s^2+15s+100)}$$

Q.6 a. Explain the concept of Neuro-Fuzzy adaptive control system. Explain one method of adaptive control. (10)

b. Derive the expression for solution of homogeneous equation. (10)

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