



Q. P. Code: 36810

(3 Hours)

Max Marks: 80

- Note:**
1. Question No. 1 is compulsory.
 2. Out of remaining questions, attempt any three questions.
 3. Assume suitable additional data if required.
 4. Figures in brackets on the right hand side indicate full marks.

1. (A) Explain Mason's Gain Formula. (05)
- (B) Differentiate between Open Loop and Closed Loop Control System (05)
- (C) Explain the concept of relative stability. (05)
- (D) Explain the concept of Neuro-Fuzzy adaptive control system. (05)

2. (A) The open-loop transfer function of a unity feedback system is – (10)

$$G(s) = \frac{20}{s(1+4s)(1+s)}$$

Evaluate the static error coefficients for the system. Obtain the steady-state error of the system when subjected to an input given by the polynomial –

$$r(t) = 2 + 4t + \frac{t^2}{2}$$

- (B) Test the stability of the system represented by following characteristic equations.

i) $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0.$

ii) $s^5 + 2s^4 + 3s^3 + 6s^2 + 2s + 1 = 0.$

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

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

- (B) Sketch the root locus for the below given System. (10)

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

4. (A) Determine the $C(s)/R(s)$ of the signal flow graph given in Fig. 4(a). (10)

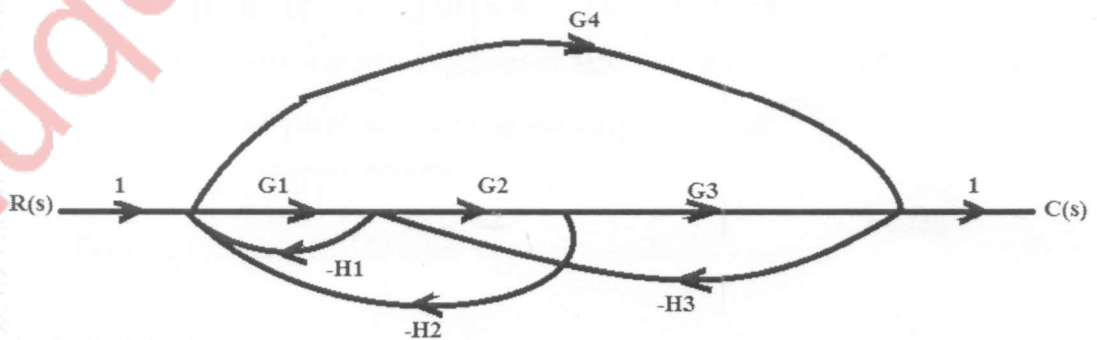


Fig. 4(a): Signal flow graph

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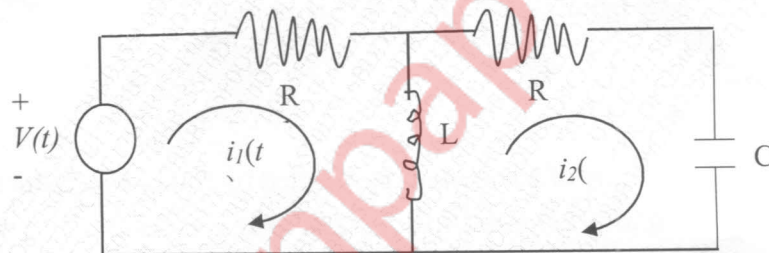
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- (B) Draw the Bode diagram for the transfer function (10)

$$G(s) = \frac{Ks^2}{(1 + 0.2s)(1 + 0.02s)}$$

Determine gain K for gain cross over frequency ω_{gc} to be 5 rad/sec. Comment on the stability.

5. (A) Explain Controllability and Observability analysis of LTI System using Suitable example. (10)
 (B) Draw block diagram of Model Reference Adaptive Control and explain its function. (05)
 (C) Define the transfer function and find the transfer function of following electrical network (05)



6. (A) Sketch the polar plot for the following system. (10)

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

Determine the gain and phase margin of the system.

- (B) A linear time invariant system is characterized by the state variable model. Examine the observability of the system. (10)

$$A = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & -3 \\ 0 & 1 & -4 \end{bmatrix}, \quad B = \begin{bmatrix} 40 \\ 10 \\ 0 \end{bmatrix}, \quad C = [0 \quad 0 \quad 1]$$