

**N.B.:** (1) Question No.1 is compulsory.

(2) Attempt any three out of remaining questions.

(3) Assume suitable data wherever required.

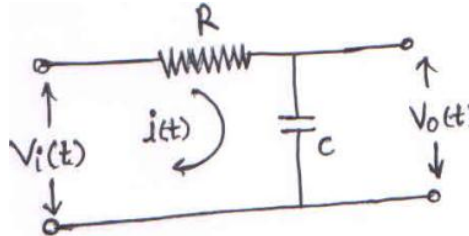
Q.1 Attempt the following

(20)

- Compare Linear and Nonlinear Systems
- State and explain Mason's gain formula
- What is optimal control? Why optimal control is needed.
- Define the terms.
  - State
  - State variables
  - state vector
  - State Space

Q.2 a. For a system shown below, Calculate its transfer function where  $V_o(t)$  is output and  $V_i(t)$  is input to the system

(05)



b. Explain the terms

(05)

- Zero input response
- Zero state response

c. Explain the concept of Neuro-Fuzzy adaptive control system. Explain one method of adaptive control

(10)

Q. 3 a. Derive the expression of steady state error for a simple closed system using negative feedback

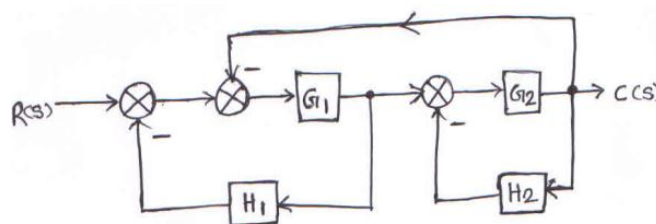
(05)

b. What are the considerations while selecting state variables?

(05)

c. Reduce the given block diagram to its canonical (simple) form and hence obtain the equivalent transfer function  $C(s)/R(s)$ .

(10)



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Q.4. a. Derive the expression for solution of homogeneous equation (10)

b. Sketch the root locus for the system with (10)

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

Q.5 a. A unity feedback control system has (10)

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

Draw bode plot. Determine  $G_m$ ,  $P_m$ ,  $W_{gc}$  and  $W_{pc}$ . Comment on the stability.

b. Explain the following terms (10)

(i) Routh's Criterion

(ii) Absolute stability and relative stability

Q.6 a. Derive the expression for Observability proof. Evaluate the Observability of the system (10)

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \text{ and } C = [3 \quad 4 \quad 1]$$

Using Kalman's test.

b. Explain the terms transient response and steady state response. (05)

c. A unity feedback system has (05)

$$G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$$

Determine (i) type of the system (ii) All error coefficients (iii) Error for ramp input with magnitude 4

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