

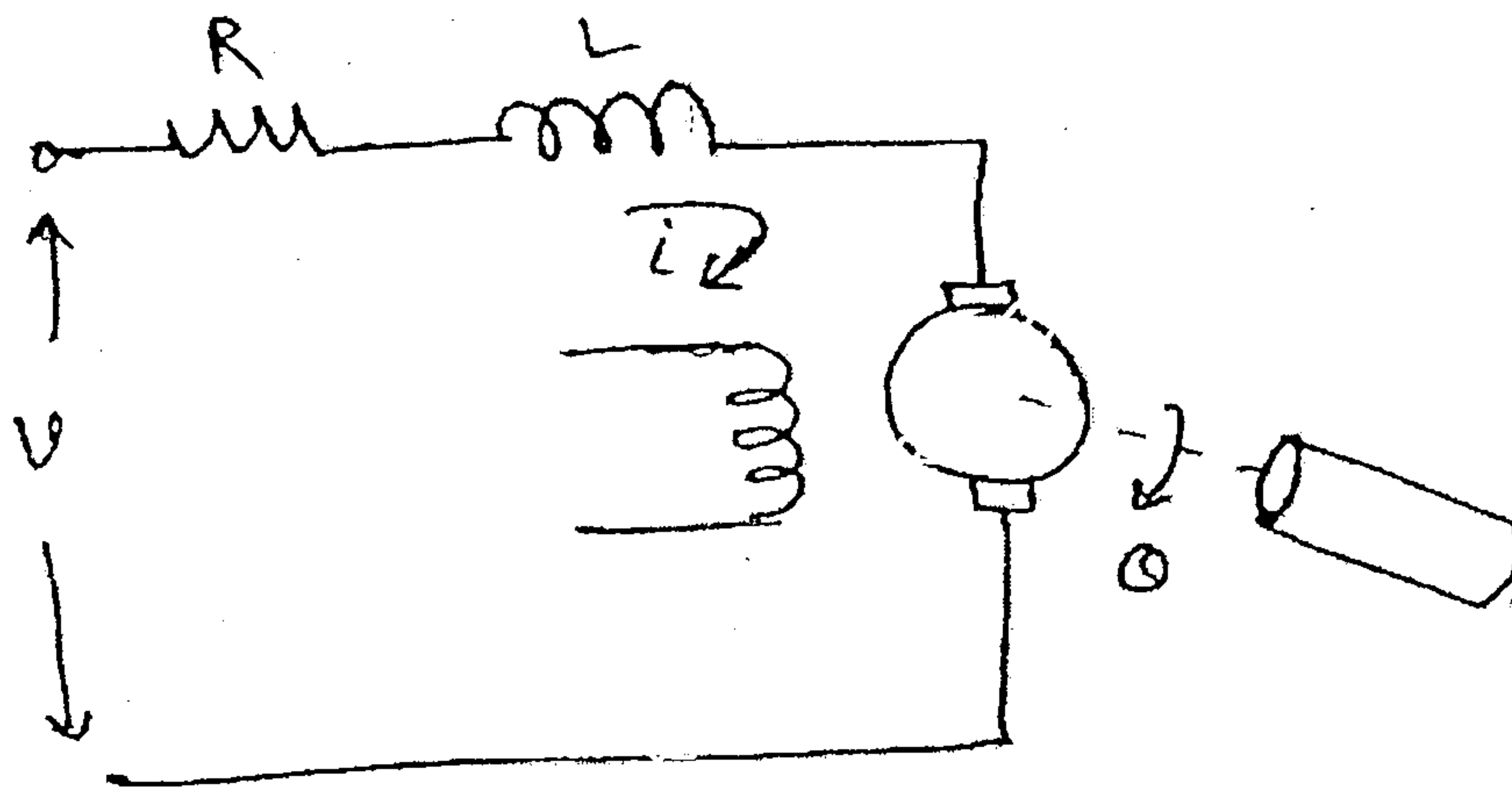
QP Code : NP-19880

(3 Hours)

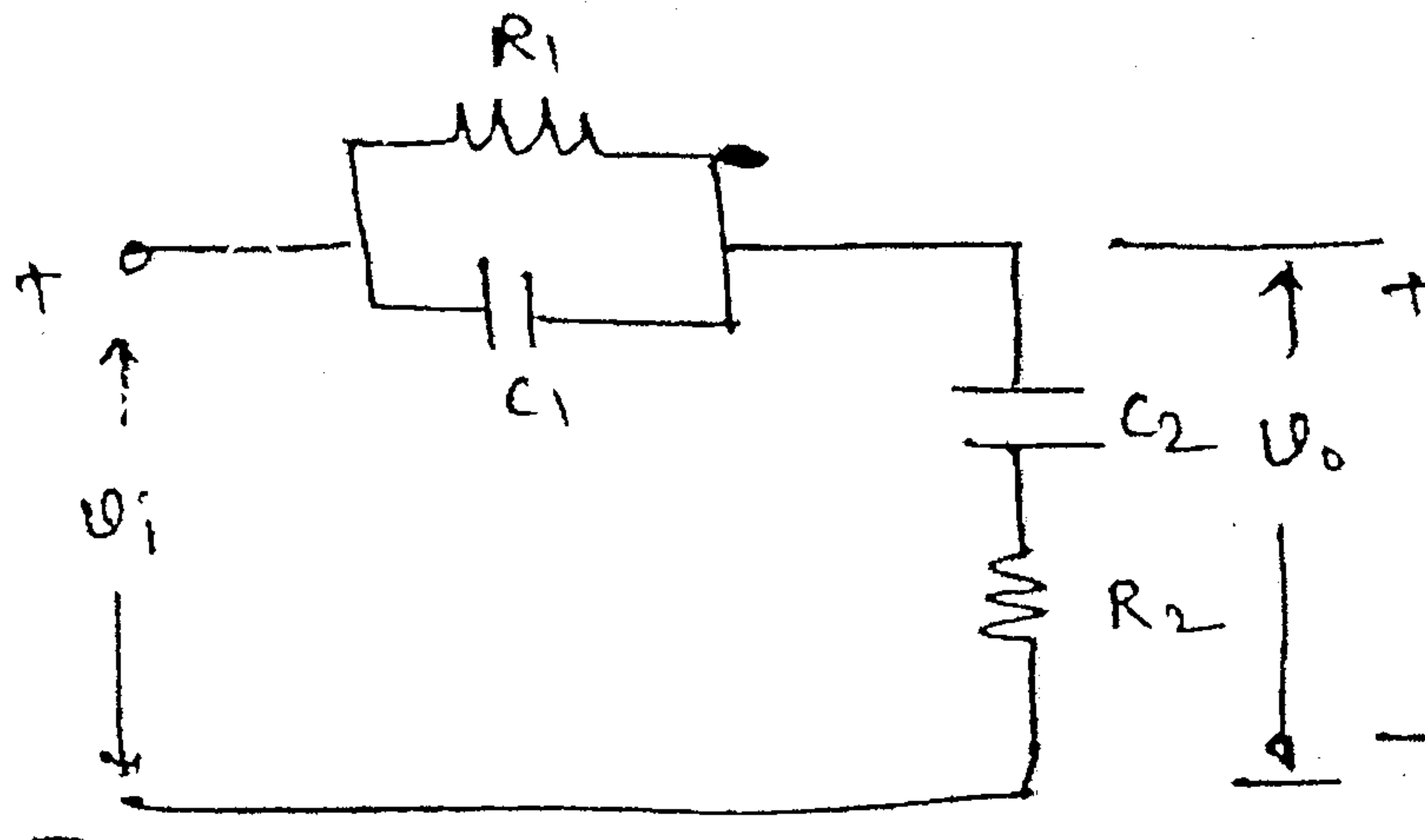
[Total Marks : 80

- N. B. : (1) Question No. 1 is compulsory.
(2) Attempt any **three** questions from **remaining** questions.
(3) **Assume** suitable data if **necessary**.

1. (a) Define relative, absolute and robust stability of the system. 20
(b) What is gain and phase margin ? Explain how to find gain and phase margin by using polar plot.
(c) Differentiate open loop and closed loop systems.
(d) What is damping ratio ? Show the location of roots in s-plane for different values of damping ratio.
2. (a) Derive the transfer function of electromechanical system shown in figure :- 10

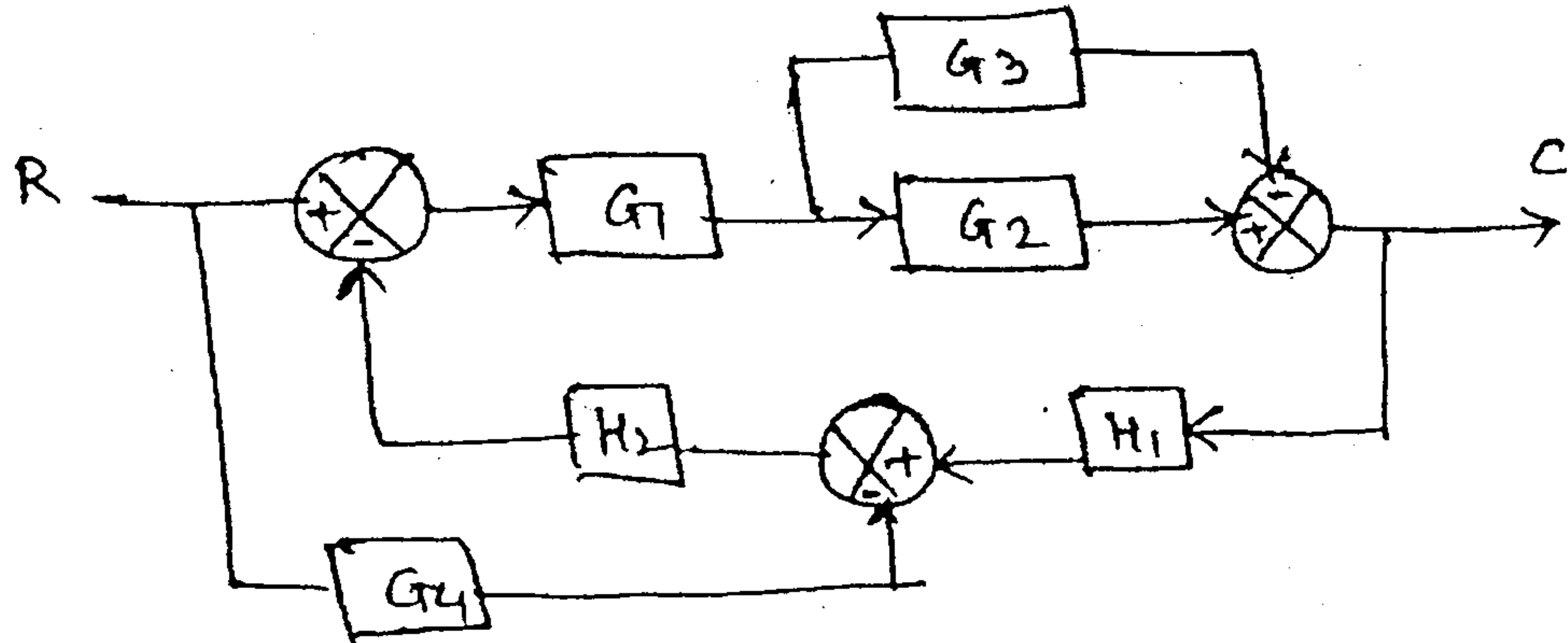


- (b) Find the transfer function of the electrical network shown in figure :- 10

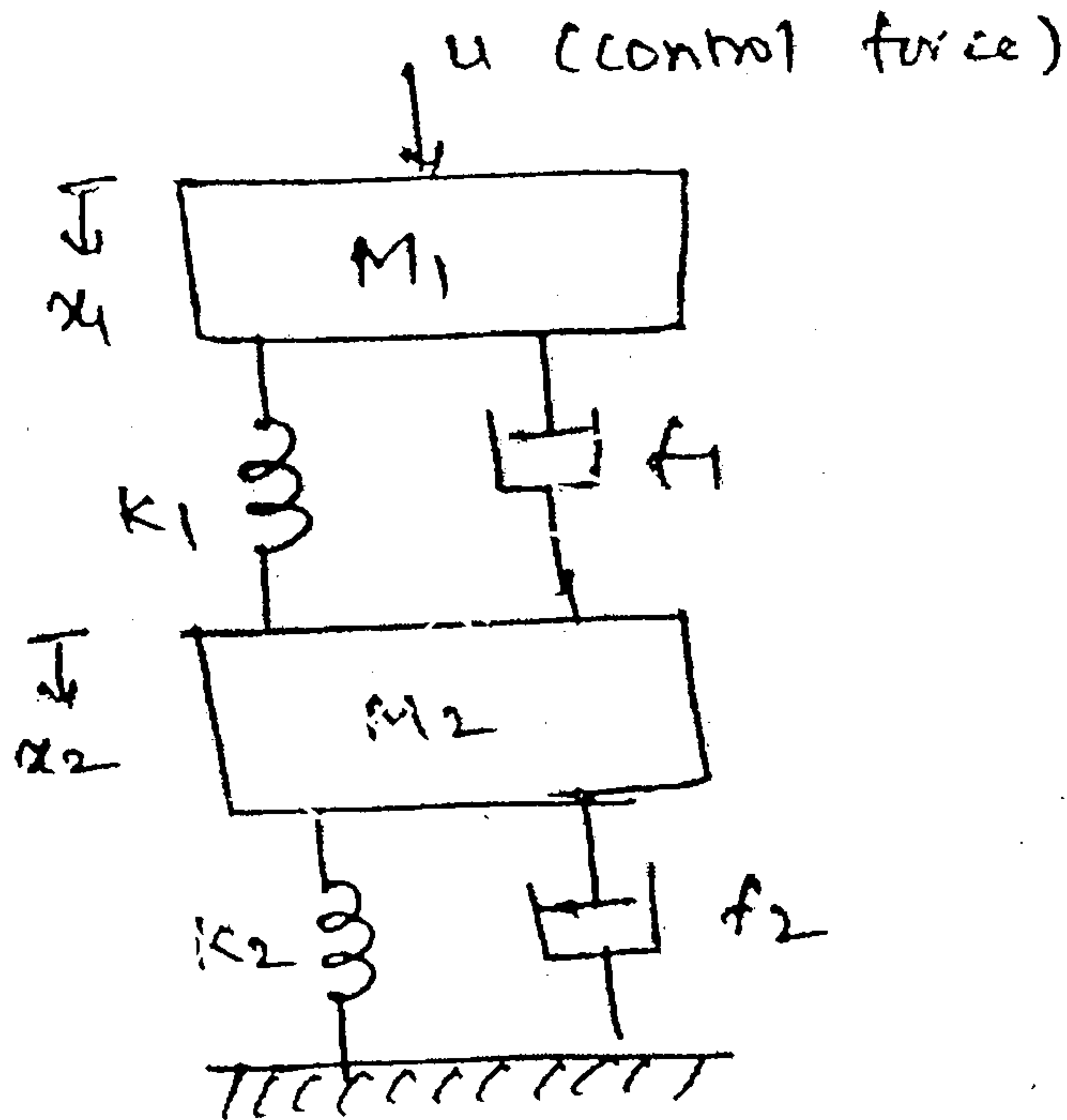


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3. (a) Find the closed loop transfer function of the system whose block diagram is given in figure :- 10



- (b) State and prove properties of state transition matrix. 5
 (c) What is optimal control ? Why optimal control is needed ? 5
4. (a) Construct a state model of the system shown in figure :- 10



- (b) Predict the controllability and observability for the system :- 10

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u$$

$$y = [1 \ 2 \ 0]x$$

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5. (a) Construct the root locus for the system having following open loop transfer function :- 10

$$G(s)H(s) = \frac{K}{(s+3)(s+5)(s^2 + 2s + 2)}$$

- (b) Construct the bode plot for the following transfer function :- 10

$$G(s) \cdot H(s) = \frac{10(s+10)}{s(s+2)(s+5)}$$

6. (a) What is adaptive control ? Explain one method of adaptive control. 7
(b) Explain how the stability of the system can be analysed using Nyquist criterion. 7
(c) Explain the time domain specifications. 6