

(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) Compare open loop and closed loop systems with suitable examples. 5

(b) Draw the step response for an underdamped second order system with damping ratio 0.2, 1, 1.2 respectively. 5

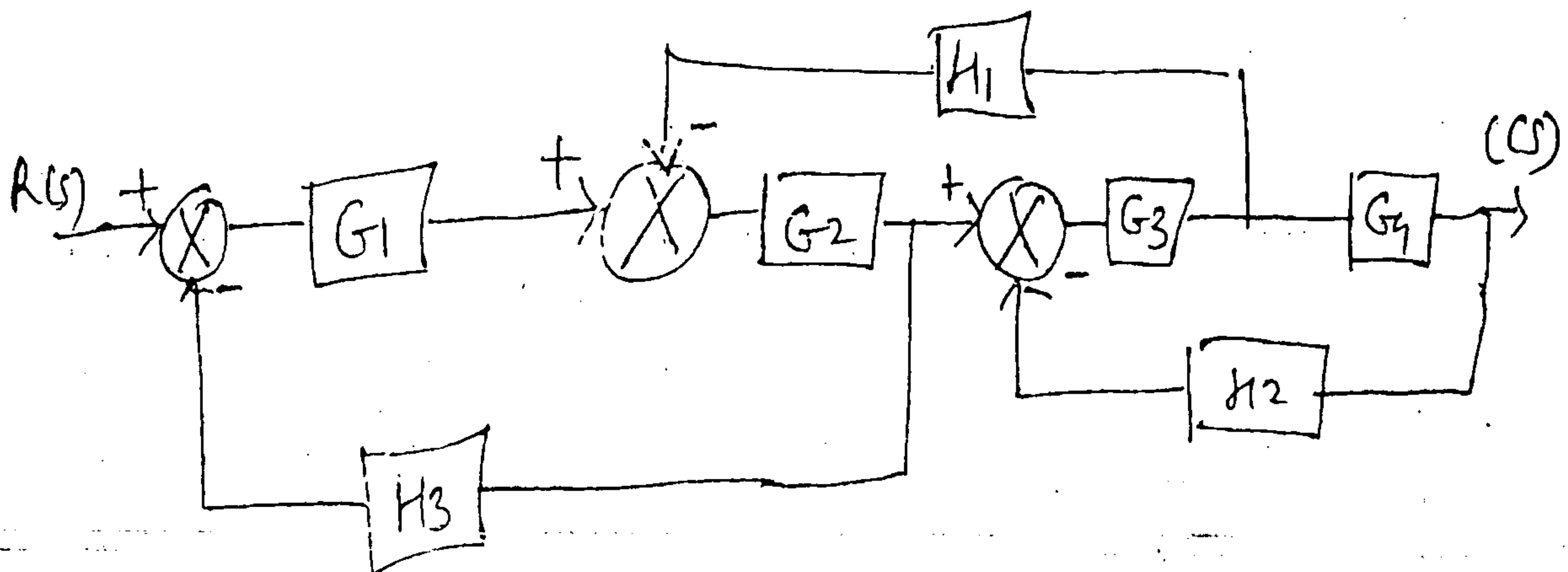
(c) The transfer function of a system is given by - 5

$$T(s) = \frac{k(s+6)}{s(s+2)(s+5)(s^2+7s+1^2)}$$

Determine (i) poles (ii) zeros (iii) Characteristic equation

(d) Define Hurwitz stability Criteria with its advantages and disadvantages. Give suitable example. 5

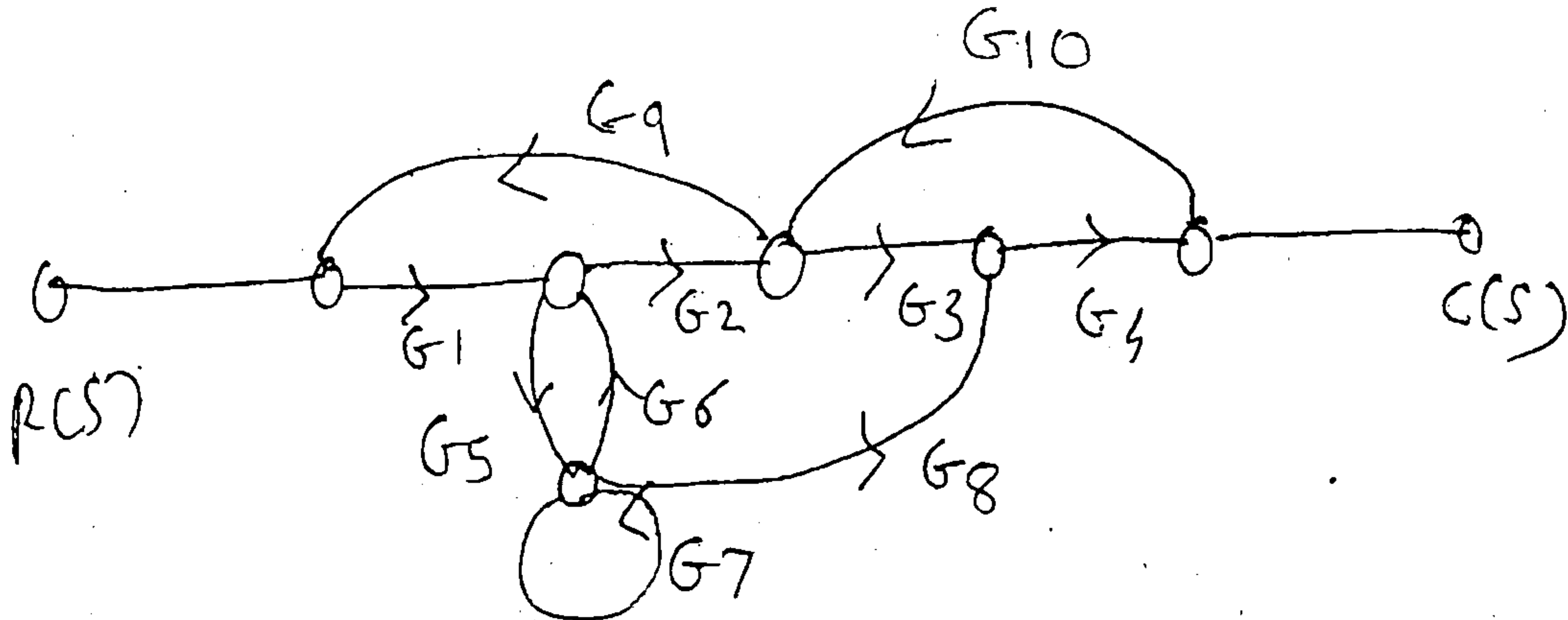
2. (a) Determine transfer function $C(S) / R(S)$ of the system shown in fig. 10



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(b) using Mason's gain formula, find $C(S)/R(S)$ of SFG shown in fig.

10

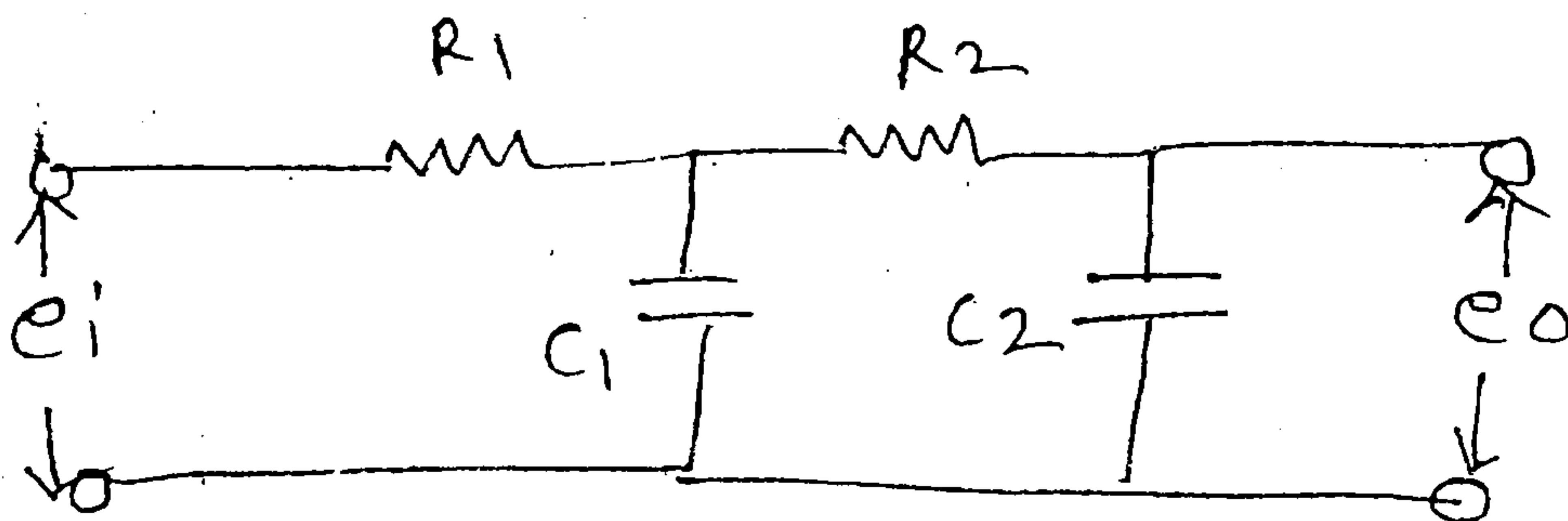


3. (a) Show the pole zero location and the unit step response of the following second order control system - 10

- (1) Underdamped
- (2) Overdamped
- (3) Critically damped
- (4) Undamped

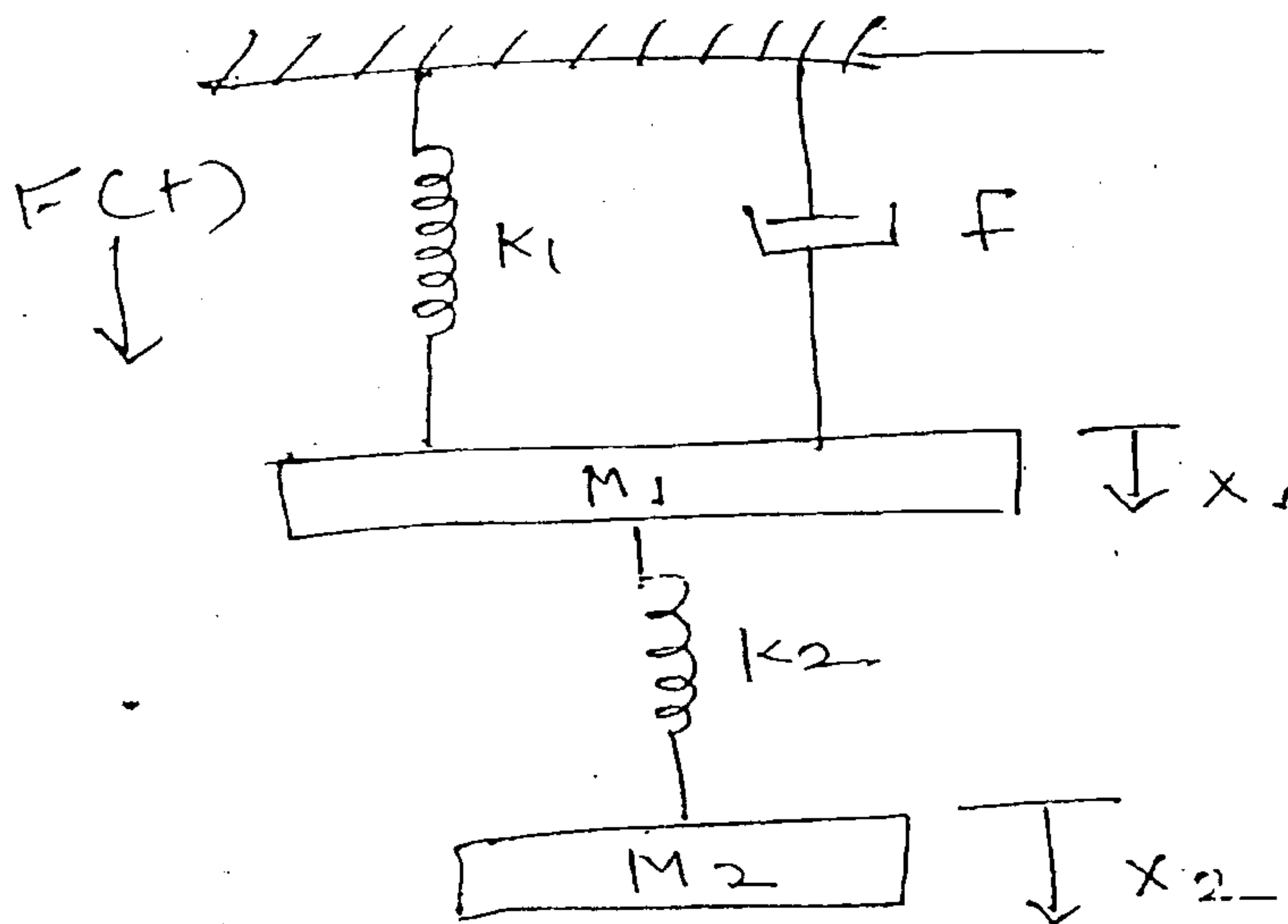
(b) For the Network shown in fig obtain - 10

- (i) Transfer function
- (ii) State variable model



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4. (a) Write the differential equation for the mechanical system shown in fig and explain force voltage analogy. 10



- (b) The open loop transfer function of a unity feedback system is given by 10

$$G(S) = \frac{k(s+9)}{s(s^2 + 4s + 11)}$$

Sketch the Root locus of the system.

5. (a) Sketch the polar plot for the open loop transfer function given by - 10

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

- (b) A unity feedback system has 10

$$G(s) = \frac{40(s+2)}{s(s+1)(s+5)}$$

- Determine (i) Type of system
(ii) All error coefficients
(iii) Error for ramp I/P with magnitude 3.

6. (a) Sketch the bode plot for the following Transfer function. 10

$$G(s) = \frac{75(1+0.25s)}{s(s^2 + 16s + 100)}$$

- (b) What is Adaptive control ? Explain any one of adaptive control methods. 5
(c) Explain controllability and observability. 5