

28 : 1st half.13-AM(y)

Con. 6566-13.

GS-6516

(3 Hours)

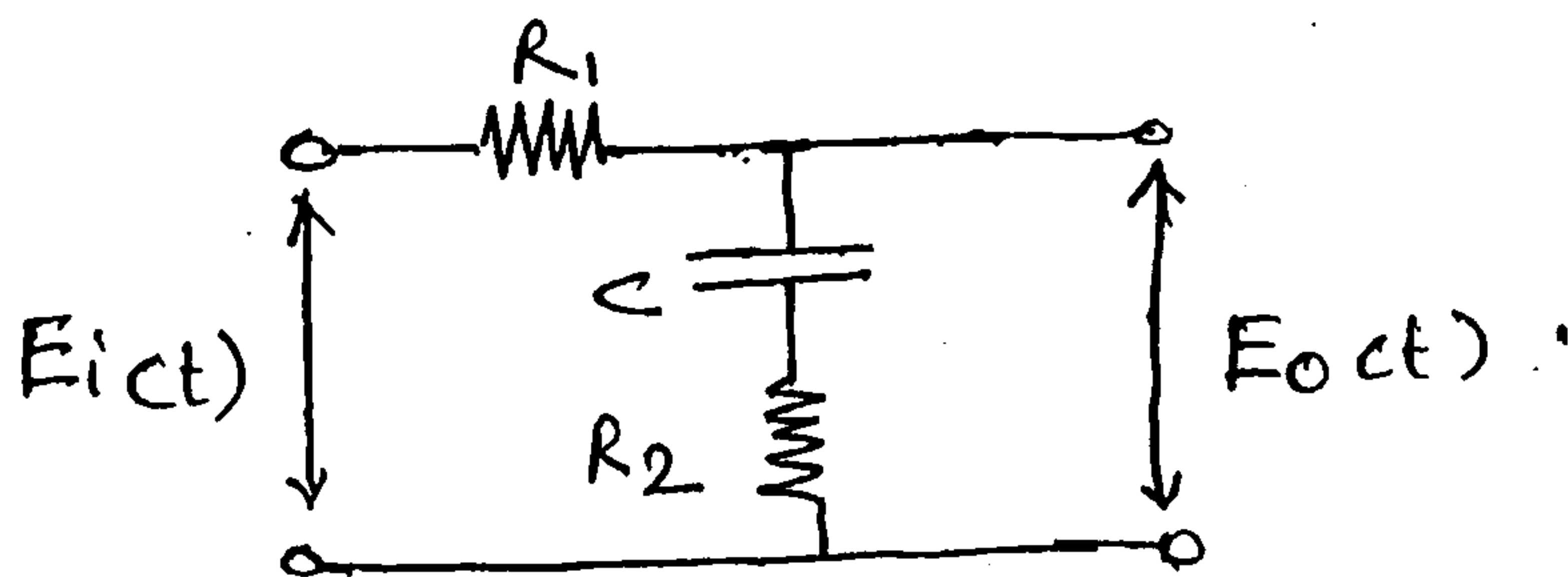
[Total Marks : 100]

- N.B. : (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining **six**.
 (3) Assume suitable **data** wherever required and **justify** it.
 (4) **Figures** to the **right** indicate **full marks**.

1. Solve the following :—

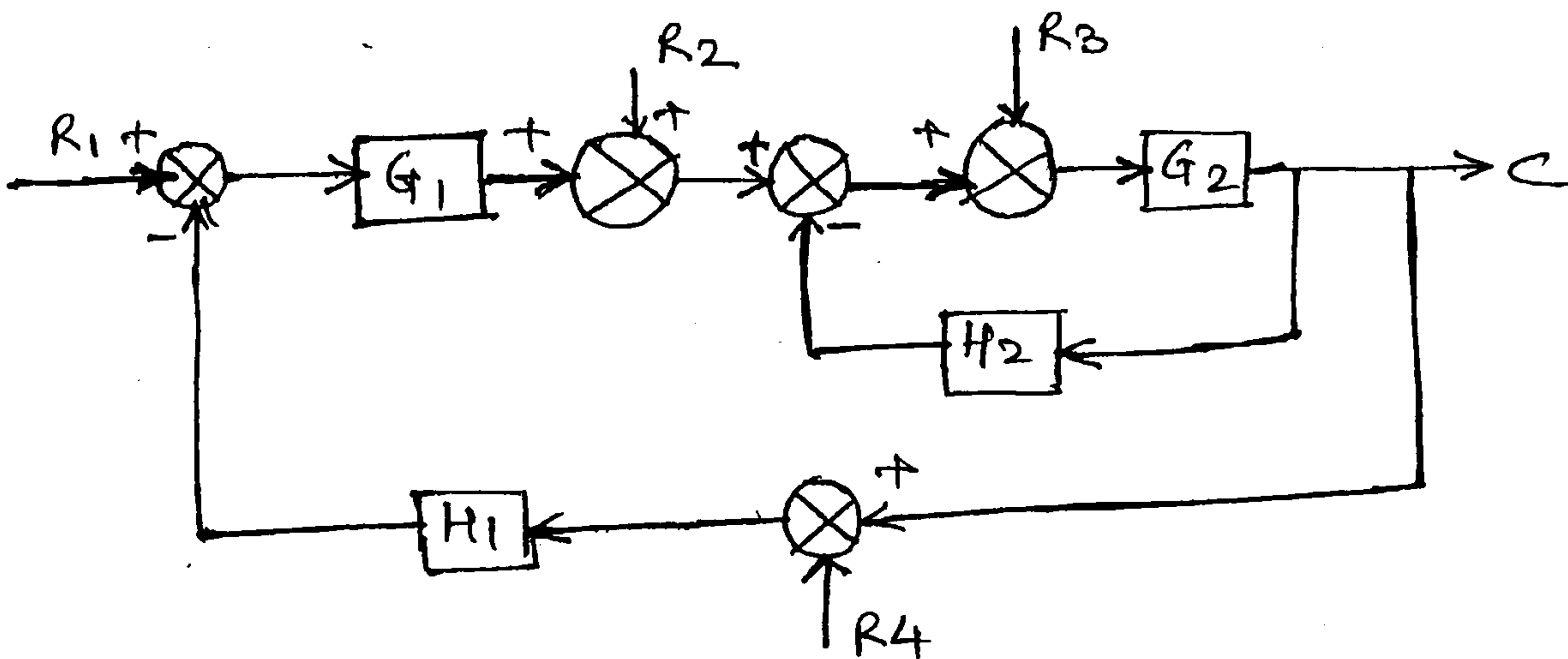
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(a) Obtain the transfer function of the lag network shown in figure below :



- (b) Explain how to find gain margin and phase margin from polar plot.
 (c) Compare the time response analysis with frequency response analysis.
 (d) Explain various rules for block diagram reduction method to find out the transfer function.

2. (a) Find the total transfer function $\frac{C}{R}$ using block reduction technique for the figure below :



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- (b) For a unity feedback control system the forward path transfer function is 10
given by

$$G(s) = \frac{20}{s(s+2)(s^2+2s+20)}$$

Determine the steady state error of the system, when the inputs are :—

(i) 5

(ii) 5t

(iii) $\frac{3t^2}{2}$

3. (a) The characteristic equations for certain feedback control system are given 10
below. Determine the range of values of k for the system to be stable.

(i) $s^4 + 20ks^3 + 5s^2 + 10s + 15 = 0$

(ii) $s^3 + 2ks^2 + (k+2)s + 4 = 0$

- (b) Sketch the complete root locus for the system having the openloop transfer 10
function.

$$G(s)H(s) = \frac{k}{s(s+3)(s^2+3s+4.5)}$$

4. (a) A unity feedback system has open-loop transfer function 10

$$G(s) = \frac{192s(s+1)}{s^2 + (s+4)(s+12)}$$

Draw the Bode plot and determine the gain margin and phase margin and
state whether the system is stable or not ?

- (b) Sketch the polar plot and discuss the stability of the system represented by 10

$$G(s)H(s) = \frac{k}{s(s+1)(s+5)}$$

5. (a) Derive the value of k_p , k_v and k_a for type 0, type 1, type 2, system. 5

- (b) Show the location of poles of a second order control system for various 5
values of damping ratio.

- (c) A unity feedback system has openloop transfer function 10

$$G(s) = \frac{3(2-s)}{(s+1)(s+5)}$$

Using Nyquist stability criterion, check **whether** the closed loop system is
stable. If system is stable, find the gain **margin** and phase margin.

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6. (a) Draw the circuit diagram of basic lag and lead networks and derive their respective transfer functions. **10**
- (b) Explain different composite continuous controllers. **10**
7. Write short notes on the following :— **20**
- (a) Masons gain formula and its applications
 - (b) Stepper motor
 - (c) Effect of adding zero to a second order control system
 - (d) Synchro transmitter – receivers.
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