

(3 Hours)

[Total Marks : 100

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any four questions out of remaining six questions.
 (3) Assume suitable data wherever necessary.
 (4) Figures to the right indicate full marks.

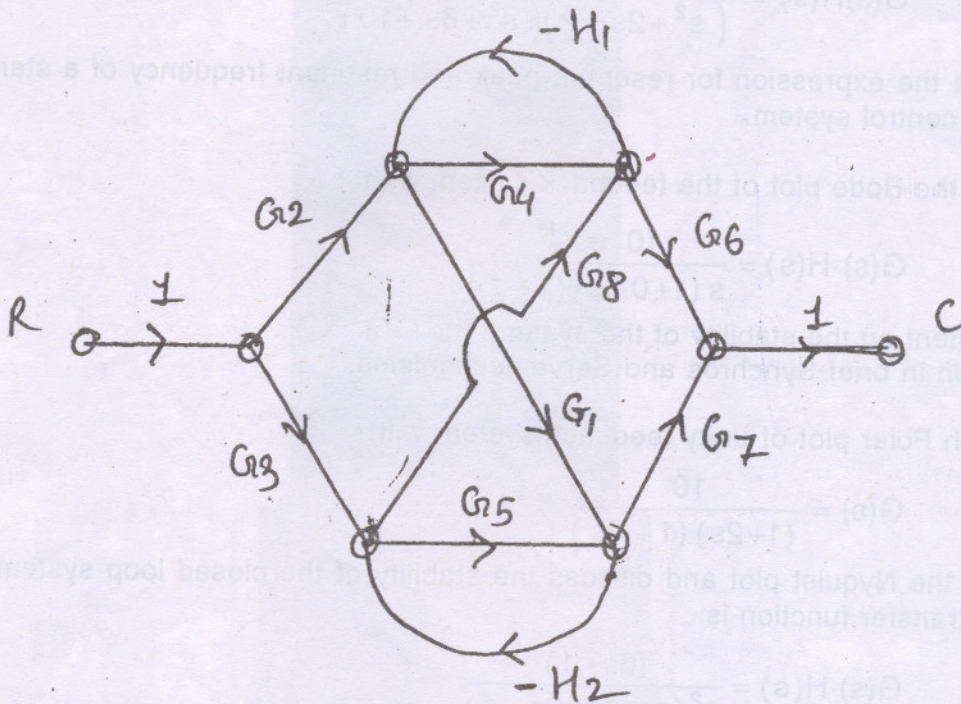
1. Answer the following (any five) :-

20

- Explain the effect of addition of Poles and Zeros on Root Locus of a system.
- Draw step, impulse and ramp response of standard second order underdamped system.
- How to find gain margin and phase margin from Bode plot ?
- Explain the concept of damping.
- Define Absolute and Relative stability.
- How stability of a system can be predicted from Nyquist plot.

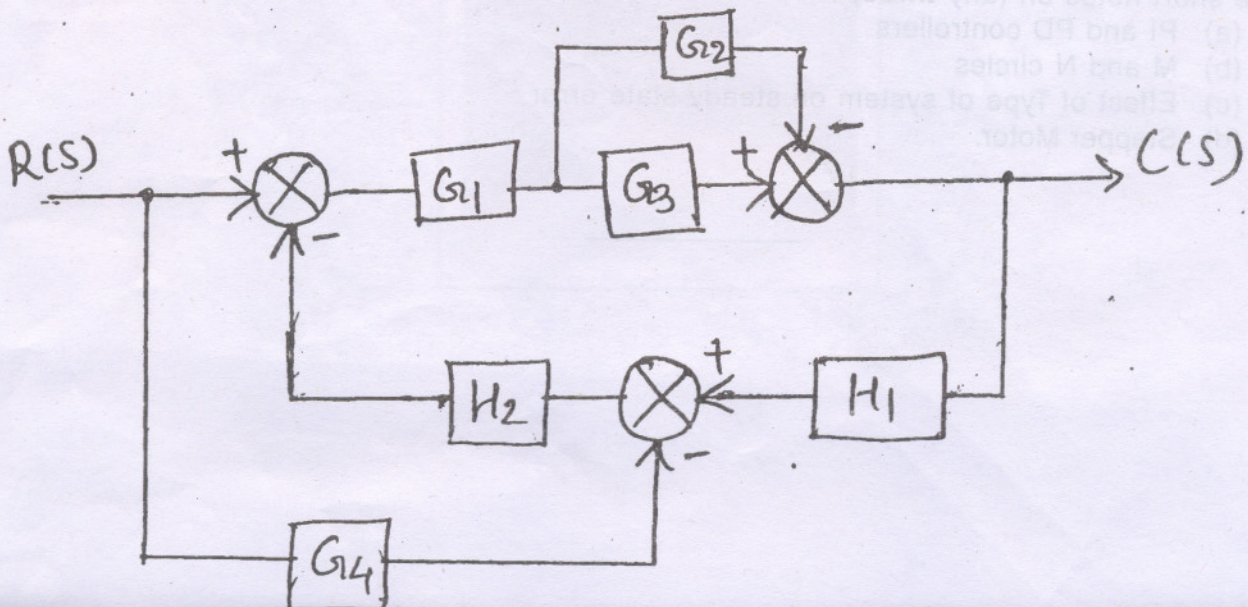
2. (a) For the system shown below determine the transfer function using SFG technique.

10



(b) For the Block Diagram shown obtain the transfer function.

10



3. (a) A system is described by the equation

12

$$\frac{d^2 c(t)}{dt^2} + 4 \frac{d c(t)}{dt} + 8c(t) = 8r(t)$$

Where $r(t)$ and $c(t)$ are input and output of the system. Determine all time domain specifications and the expression for unit step response. Also find frequency of oscillations.

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

8

$$G(s) = \frac{K}{(s+2)(s+4)(s^2+6s+25)}$$

- (i) Using Routh Criterion discuss the stability of the system as a function of K .
 (ii) Determine the value of K which will cause sustained oscillations in the close loop system and find the corresponding oscillation frequency.

4. (a) Comment on the stability of the system using Root Locus :

12

$$G(s)H(s) = \frac{K}{(s^2+2s+2)(s^2+6s+10)}$$

- (b) Derive the expression for resonant peak and resonant frequency of a standard second order control system.

8

5. (a) Draw the Bode plot of the feedback system with

12

$$G(s) \cdot H(s) = \frac{10 \cdot e^{-0.1s}}{s(1+0.1s)(1+s)}$$

Comment on the stability of the system.

- (b) Explain in brief Synchros and Servomechanisms.

8

6. (a) Sketch Polar plot of unity feedback system with

8

$$G(s) = \frac{10}{(1+2s)(1+3s)}$$

- (b) Draw the Nyquist plot and discuss the stability of the closed loop system whose open loop transfer function is

12

$$G(s) \cdot H(s) = \frac{(6s+1)}{s^2(s+1)(3s+1)}$$

7. Write short notes on (any **three**) :—

20

- (a) PI and PD controllers
 (b) M and N circles
 (c) Effect of Type of system on steady state error
 (d) Stepper Motor.