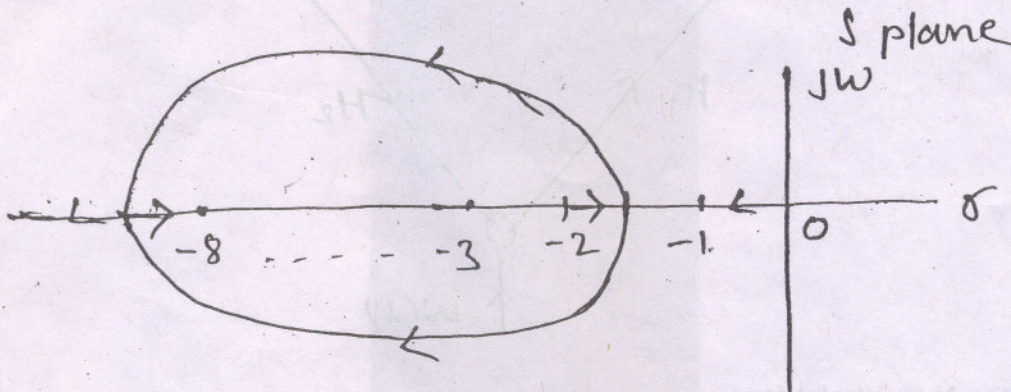


- N.B.** (1) Question No. 1 is compulsory.  
 (2) Answer any four questions out of remaining six questions.  
 (3) Assume suitable data wherever necessary.  
 (4) Figures to the right indicate full marks.

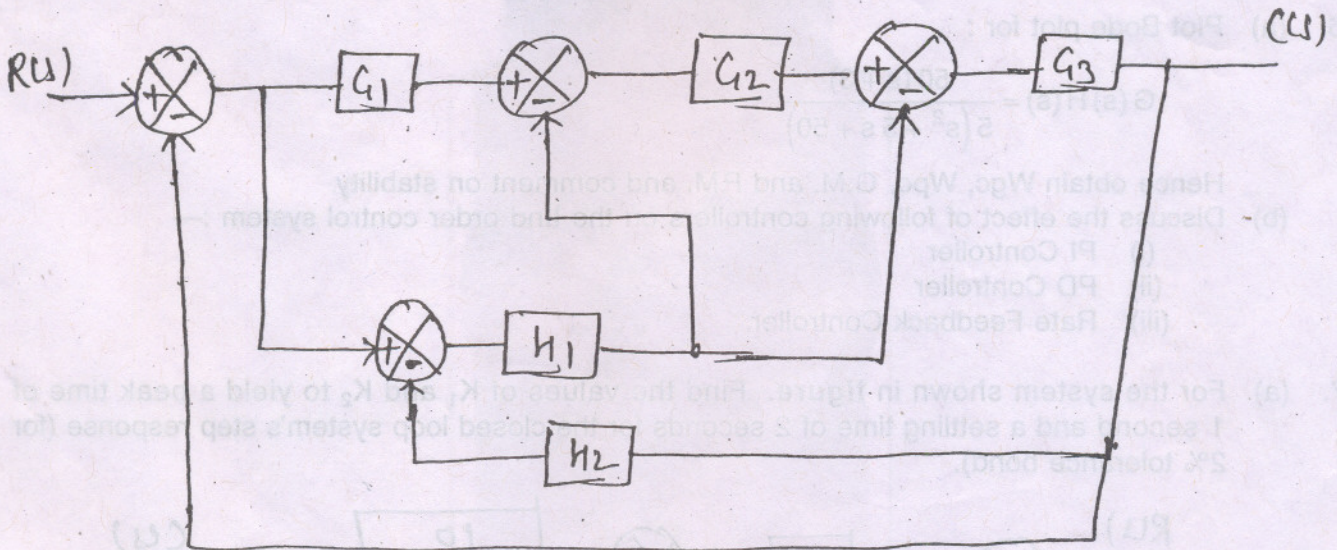
1. Answer the following :—

- (a) Derive expression for peak resonant of standard second order control system. 4  
 (b) List the types of static error constants and comment on its value as the type of system increases. 4  
 (c) The root locus of a unity feedback system is as shown below. Determine the open loop transfer function of the system. 4



- (d) Explain principle of argument. 4  
 (e) Differentiate between Bode plots and Polar plots. 4

2. (a) Find  $C(s)/R(s)$  by using Block diagram reduction technique. 10



(b) Comment on stability of the system using Nyquist Stability Criterion : 10

$$G(s)H(s) = \frac{2(s + 0.25)}{s^2(s + 1)(s + 0.5)}$$

3. (a) Sketch the root locus :

10

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

Find  $K$  marginal,  $\omega$  marginal and comment on stability.

(b) Explain in brief 'Synchros'. How it can be used as error detector ?

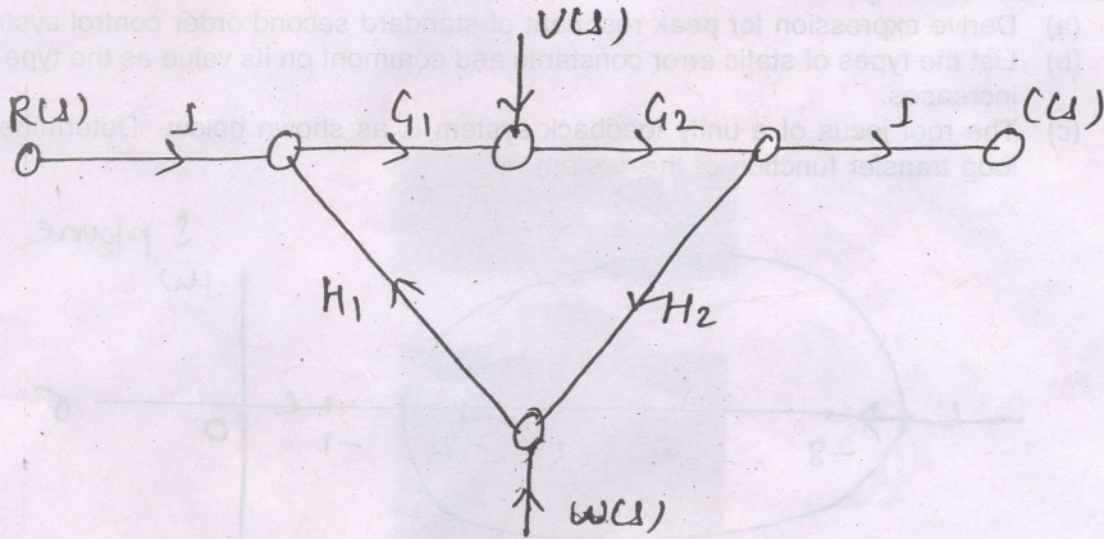
10

4. (a) If  $G(s)H(s) = \frac{K}{s(1+2s)(1+0.1s)}$ , using polar plot determine the range of K for stability. 10

Verify your results by Routh criterion.

(b) Differentiate between A.C. Servo motor and Conventional A.C. motor. Derive transfer function of A.C. Servo motor. 10

5. (a) Find the value of C(s) using Mason's Gain formula. 10



(b) Draw the Nyquist plot for : 10

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

Hence, comment on stability.

6. (a) Plot Bode plot for : 10

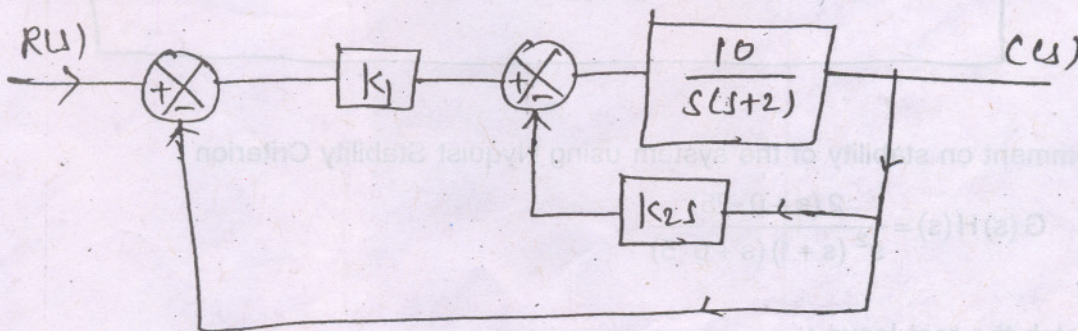
$$G(s)H(s) = \frac{50(s+3)}{5(s^2+5s+50)}$$

Hence obtain  $W_{gc}$ ,  $W_{pc}$ , G.M. and P.M. and comment on stability.

(b) Discuss the effect of following controllers on the IInd order control system :— 10

- (i) PI Controller
- (ii) PD Controller
- (iii) Rate Feedback Controller.

7. (a) For the system shown in figure. Find the values of  $K_1$  and  $K_2$  to yield a peak time of 1 second and a settling time of 2 seconds for the closed loop system's step response (for 2% tolerance band). 10



(b) (i) Write short note on M and N circles. 6

(ii) Plot Root locus for the following open loop transfer function :— 4

- (1)  $K/s$
- (2)  $Ks^2$
- (3)  $Ks^3$
- (4)  $K/s^4$