

Con. 3203-08.

CO-9752

(REVISED COURSE)

(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 whenever necessary.  
 (4) Figures to the right indicate full marks.

1. Answer the following (any five) :—

20

- Derive the expression for peak time of a standard second order control system.
- Explain how to find  $K_p$ ,  $K_v$  and  $K_a$ .
- Traffic signal system is open loop system, Justify.
- Examine stability of the fourth order system having characteristic equation  $s^4 + 2s^3 + 6s^2 + 10s + 3 = 0$ .
- State and explain any four rules on which root locus is based.
- How to find G.M. and P.M. from polar plot ?

2. (a) The characteristic equation of a unity feed back system is given by

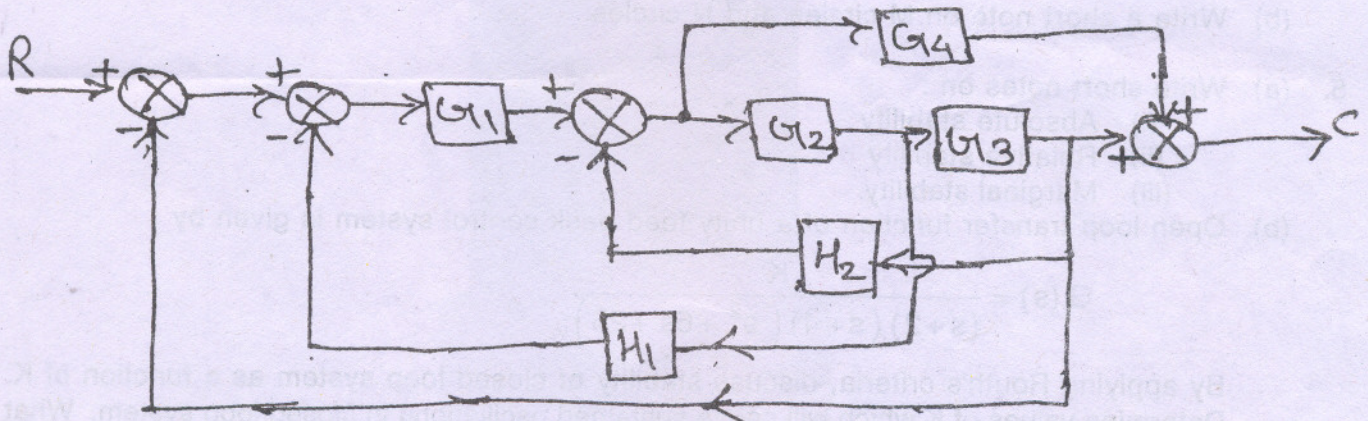
12

$$s(s + 3)(s^2 + 2s + 2) + K = 0.$$

Sketch the root locus of the above system.

(b) Derive the expression for  $C(t)$  of a underdamped standard second order control system. 8

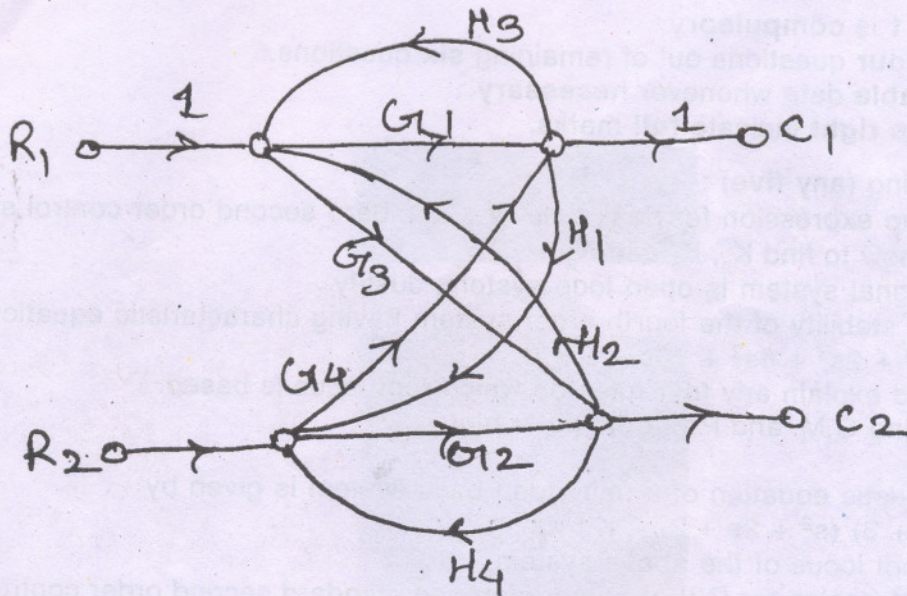
3. (a) (i) Find the overall transfer function  $C/R$  for the multifeedback system shown below : 12



- (ii) If the input to block  $G_3$  is not exceed 1.6, what is the maximum value of output  $C$  that can be obtain if  $H_1$  and  $H_2$  are the feedback elements and the gains of the elements associated with the forward path are  $G_1 = 7$ ,  $G_2 = 10$ ,  $G_3 = 5$  and  $G_4 = 10$ .

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- (b) For the system shown, determine  $C_2$  in terms of  $R_1$  and  $R_2$  and derive the condition when  $R_1$  cannot have any effect on  $C_2$ . 8



4. (a) Sketch the Nyquist plot for the system having :  $G(s) \cdot H(s) = \frac{5}{(1+0.5s)(1+0.25s)}$  15  
 (b) Write a short note on M circles and N circles. 5
5. (a) Write short notes on : 8  
 (i) Absolute stability  
 (ii) Relative stability  
 (iii) Marginal stability.
- (b) Open loop transfer function of a unity feed back control system is given by 12

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

By applying Routh's criteria, discuss stability of closed loop system as a function of K. Determine values of K which will cause sustained oscillations in closed loop system. What are corresponding oscillation frequency ?

6. (a) Sketch the polar plot of the unity feedback system with  $G(s) = \frac{10}{s(1+2s)(1+4s)}$  10  
 (b) Write short notes on : 10  
 (i) Synchros (ii) Servomechanisms.

7. (a) For a particular unity feedback system  $G(s) = \frac{242(s+5)}{s(s+1)(s^2+5s+12)}$  15

Sketch the Bode Plot. Find  $w_{gc}$  and  $w_{pc}$  G.M., P.M. comment on stability.

- (b) Plot the root locus of 5  
 (i)  $s$  (ii)  $1/s$  (iii)  $s^2$  (iv)  $1/s^3$ .