

- 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 :-

- (a) Construct the SFG of the following set of simultaneous equations : 4

$$Y_2 = t_{21} Y_1 + t_{23} Y_3$$

$$Y_3 = t_{31} Y_1 + t_{32} Y_2 + t_{33} Y_3$$

$$Y_4 = t_{42} Y_2 + t_{43} Y_3$$

- (b) Define the following terms :- 4

(i) Delay time

(ii) Rise time

(iii) Settling time

(iv) Peak over shoot.

- (c) Explain how to find GM and PM. F20m polar plot. 4

- (d) Traffic signal system is open loop system. Justify. 4

- (e) Draw the Bode plot for following functions : 4

(i)  $G(s) H(s) = 1/s$

(ii)  $G(s) H(s) = s^2$

(iii)  $G(s) H(s) = 1/s^3$

(iv)  $G(s) H(s) = s$

2. (a) Sketch the complete root locus for the system having  $G(s) H(s) = \frac{k(s+5)}{s^2+4s+20}$  and comment on stability. 10

- (b) What are the applications of Routh criterion ? For unity feed back system, system is marginally stable and oscillates with frequency 4 rad/sec. Find  $k_{\text{marginal}}$  and  $q$ . 10

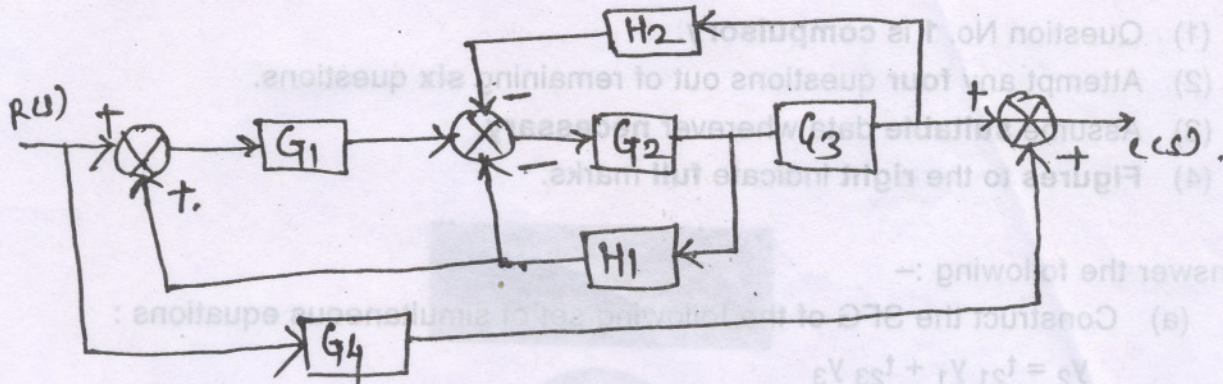
$$G(s) = \frac{4}{(s^2 + qs + 2k)s}$$

3. (a) Draw the Bode Plot for feed back system has  $G(s) H(s) = \frac{0.02(s+10)}{s^2(s+0.1)}$ . Determine GM and PM. 12

- (b) Derive expression for peak resonant and resonant frequency of standard second order control system : 8

4. (a)

10



Find C/R using Block diagram reduction technique.

(b) Derive the expression for the response  $c(t)$  of critically damped second order control system. 10

5. (a) Draw the polar plot for a system given by  $G(s)H(s) = \frac{100}{s(s+2)(s+4)(s+8)}$ . Find 12

whether the system is stable and if so find GM and PM. If 100 is replaced by K find critical value of K by Routh criteria and also verify GM and PM.

(b) A second order system has overshoot of 50% and period of oscillations 0.2 sec in step response. Determine : (i) Resonant peak (ii) Resonant frequency (iii) Bandwidth. 8

6. (a) Discuss the stability of system using Nyquist Plot For :  $G(s)H(s) = \frac{20}{s(s+4)(s-2)}$ . 10

(b) Discuss the various continuous and discontinuous controller modes with their waveforms. 10

7. Write short notes (any three) :-

20

(a) Stepper Motor

(b) Servomechanism

(c) M and N circle

(d) Effect of  $\zeta$  on second order system performance.