S. E. (EXTC) sem 3 (Rev.)
Principles of control system. 15/12/07

Con. 5128-07. CD-6744

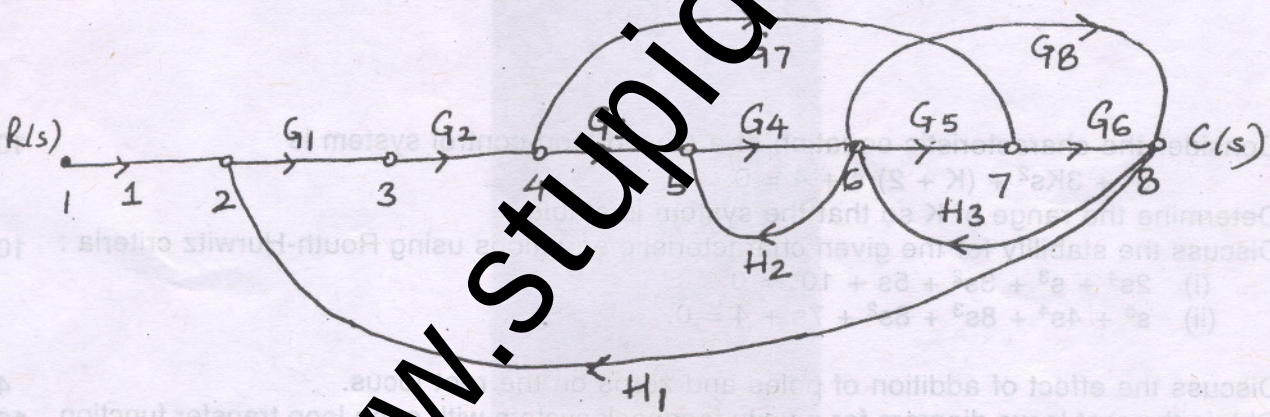
(REVISED COURSE)

(3 Hours) [Total Marks : 100

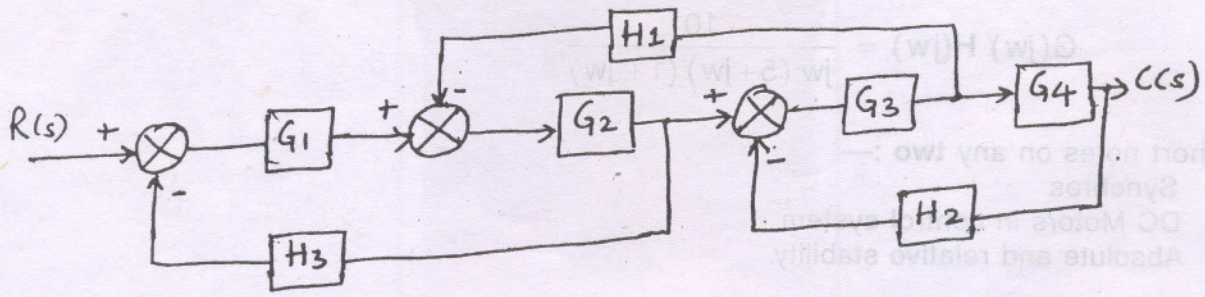
N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.

1. (a) Show the pole locations of— 5
   (i) Undamped system
   (ii) Critically damped system
   (iii) Overdamped system.
   (b) Define gain margin and phase margin. 5
   (c) Compare open-loop and closed loop control system. 5
   (d) Explain the effect of damping ratio ξ on system response. 5

2. (a) For the diagram given below, obtain transfer function using Mason's gain formula. 10

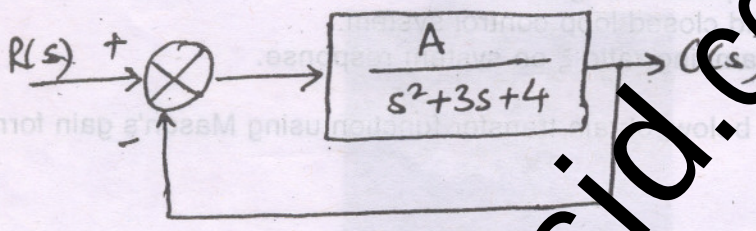


(b) Obtain transfer function for the system given below using block diagram reduction technique. 10



3. (a) A unity feedback system has open loop transfer function $G(s) = \frac{A}{s(s+p)}$. Determine the value of A and P so that the setting time and peak overshoot will be 4 seconds and 10% respectively. 10

(b) The block diagram of a closed loop system is shown below. Calculate the steady state error for values of A = 10 and 100. Hence state the effect of increasing the gain on the steady state error of the system. 10



4. (a) Consider the characteristic equation of closed loop control system is 10

$s^3 + 3Ks^2 + (K + 2)s + 4 = 0$

Determine the range of K so that the system is stable.

(b) Discuss the stability for the given characteristic equations using Routh-Hurwitz criteria : 10

(i) $2s^4 + s^3 + 3s^2 + 5s + 0 = 0$

(ii) $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$.

5. (a) Discuss the effect of addition of poles and zeros on the root locus. 4

(b) Obtain the root locus diagram for a unity feedback system with open loop transfer function 16

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

For the system to be stable, determine the range of K.

6. (a) State and explain Nyquist stability criteria. 5

(b) Draw Bode plot for the system whose open loop transfer functions is given by 15

$$G(jw)\,H(jw) = \frac{10}{jw\,(5+jw)\,(1+jw)}$$

7. Write short notes on any **two** :— 20

(a) Synchros

(b) DC Motors in control system

(c) Absolute and relative stability.