



B. Tech Degree VI Semester (Supplementary) Examination September 2010

CS/EC/EB/EI 605 CONTROL SYSTEMS ENGINEERING
(2006 Scheme)

Time : 3 Hours

Maximum Marks : 100

PART A
(Answer all questions)
(Semi log sheet may be permitted)

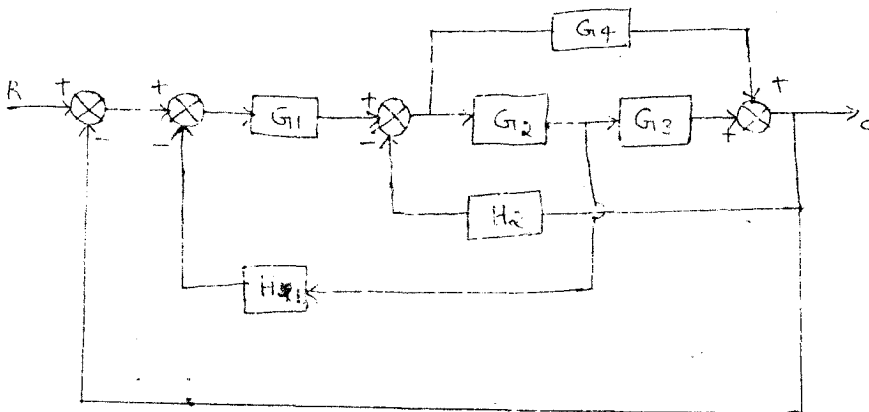
(8 x 5 = 40)

- I. (a) Obtain the Laplace transform of the function defined by
 $f(t) = 0$ for $t < 0$
 $f(t) = t^2 e^{-at}$ for $t > 0$
- (b) What is analogous systems? Compare the parameters in force -- voltage analogous system.
- (c) State and explain Routh – Hurwitz stability criterion.
- (d) Derive the expressions for the rise time and peak time of a second order underdamped system subjected to unit step input.
- (e) Explain different frequency domain specifications.
- (f) State and explain Nyquist's stability criterion.
- (g) Explain a phase lead compensator.
- (h) Explain the properties of root locus.

PART B

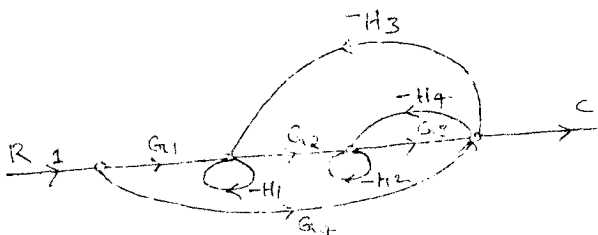
(4 x 15 = 60)

- II. Using block diagram reduction technique find the closed loop transfer function C/R of the given block diagram. (15)



OR

- III. (a) Using Mason's gain formula determine the overall transfer function of the system. (10)



(b) Find the inverse Laplace transform of $F(s) = \frac{1}{s(s+a)^2}$. (5)

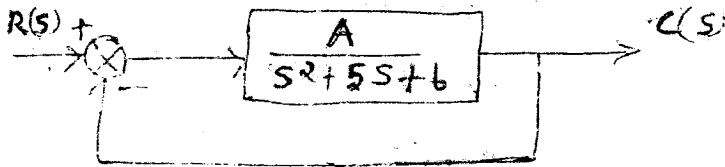
- IV. (a) Determine the range of K for stability of unity feedback system whose open loop transfer function is given by $G(s) = \frac{K}{s(s+1)(s+2)}$.

Also find the

- (i) Limiting value of K which will cause sustained oscillations
 (ii) Frequency of sustained oscillations. (10)
- (b) What is derivative control? What are its advantages? (5)

OR

- V. (a) For the given system with $A = 200$ find the maximum overshoot, rise time and time at which peak overshoot takes place. (10)



- (b) Explain PI and PD control action and its effect on the system performance. (5)

- VI. Draw Bode plot of the system whose open loop transfer function is given by

$$G(j\omega) H(j\omega) = \frac{100}{j\omega(5 + j\omega)(10 + j\omega)}$$

- Determine gain and phase margins and comment on the stability. (15)

OR

- VII. The open loop transfer function of a unity feedback system is given by

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

- Sketch the polar plot and determine the gain margin and phase margin. (15)

- VIII. Explain the magnitude and angle criterion. Obtain the root locus diagram for a unity feedback system with open loop transfer function.

$$G(s) = \frac{K}{s(s^2 + 6s + 10)}$$
 (15)

OR

- IX. Explain compensation technique. Derive transfer function of lead compensator, Lag compensator and lag-lead compensator using electrical networks. (15)