SEM-III (R) – ~~Comp~~ ETRX — May/June-2012
– Control Sys

P4-Exam.-May-12-11

Con. 4583–12. GN–8696

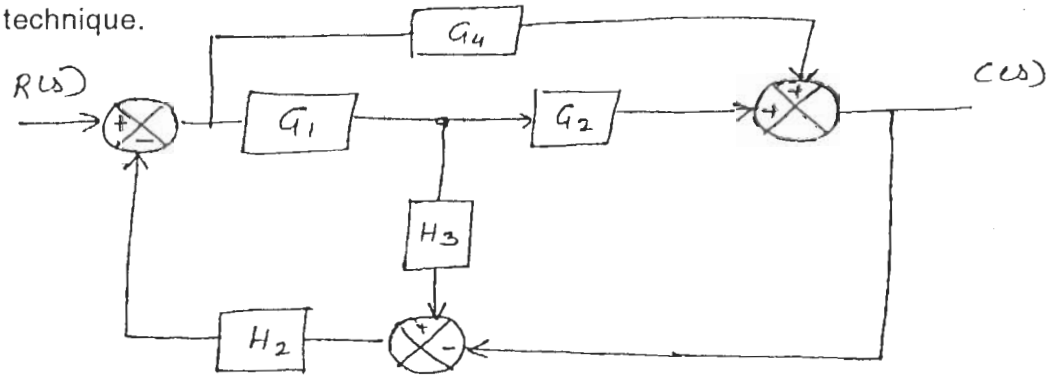
(3 Hours) [Total Marks : 100

N.B. : (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions from the remaining **six** questions.
(3) Assume **suitable** data wherever **necessary**.

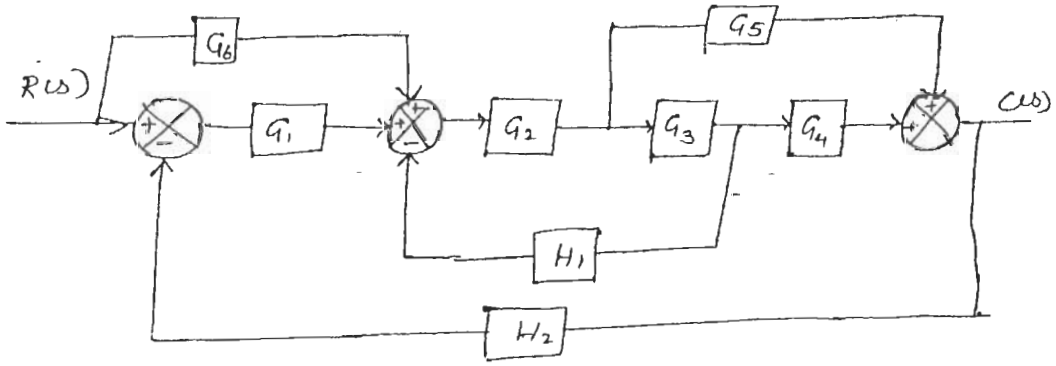
1. (a) Define static error coefficients. Explain their significance. 20
(b) Explain how roots of characteristic equation is related to stability of a system.
(c) Define gain and phase margin. Draw approximate Bode Plot for a stable system showing gain and phase margin.
(d) Explain the effect of addition of open loop poles and zeros to the root locus of the system.

2. (a) A system when subjectd to unit step input gave the following response. 10
$C(+) = 1 + 0{\cdot}2\ e^{-60t} - 1{\cdot}2\ e^{-10t}$
(i) Find the closed loop transfer function.
(ii) Find unclamped natural frequency and damping ratio.
(iii) Find settling time and peak overshoot.

(b) Find the transfer function $\frac{C(s)}{R(s)}$ for the following system using block reduction technique. 10



3. (a) Find the overall transfer function of the system using signal flow graph. Using Mason's gain formula. 10



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(b) Find the range of values of K for which the following systems are stable. **10**

(i) $G(s)\,H(s) = \dfrac{K e^{-5}}{s\left(s^2+5s+9\right)}$ (ii) $G(s)\,H(s) = \dfrac{K}{(s+2)\,(s+4)\left(s^2+6s+25\right)}$

4. (a) Derive the output response for second order underdamped control system subjected to unit step input. **10**

(b) For a unity feedback system the open loop transfer function is given by **10**

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

Sketch the root locus and find the value of K at which the system becomes unstable.

5. (a) Consider the given open loop transfer function $G(s)H(s) = \dfrac{16(1+0\cdot25s)}{s(s+2)\,(s+100)}$. Obtain the Bode Plot and find gain margin and phase margin. **10**

(b) Find Polar Plots for the transfer functions given below – **10**

(i) $G(s) = \dfrac{1}{(1+s)(1+4s)}$ (ii) $G(s)H(s) = \dfrac{1}{s(Ts+1)}$.

6. (a) Sketch the Nyquist plot and comment on the stability of the following system. **10**

$$G(s)H(s) = \frac{k(s+3)}{s(s-1)}.$$

(b) For the control systems with open loop transfer functions given below; explain the type of input signal which produce a finite steady state error. Also find the steady state error. **10**

(i) $G(s) = \dfrac{20}{(s+2)(s+3)}$

(ii) $G(s)H(s) = \dfrac{20(s+1)}{s^2(s+2)(s+4)}$

(iii) $G(s)H(s) = \dfrac{2\cdot5\left(s^2+2s+1\right)}{s(s+1)\left(s^2+5s+2s\right)}$.

7. Write short notes on the following :– **20**

(a) Co-relation between time domain and frequency domain.

(b) Synchro error ditector

(c) PI, PID Controllers

(d) Root locus techniques.