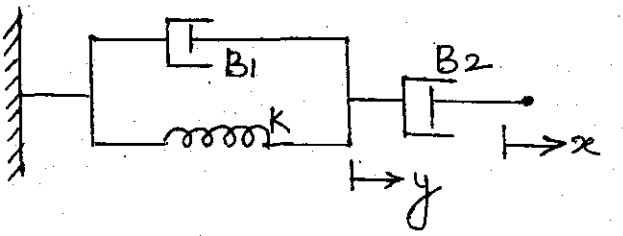
# B. Tech Degree VI Semester Examination, April 2009

## CS/EC/EB/EI 605 CONTROL SYSTEM ENGINEERING

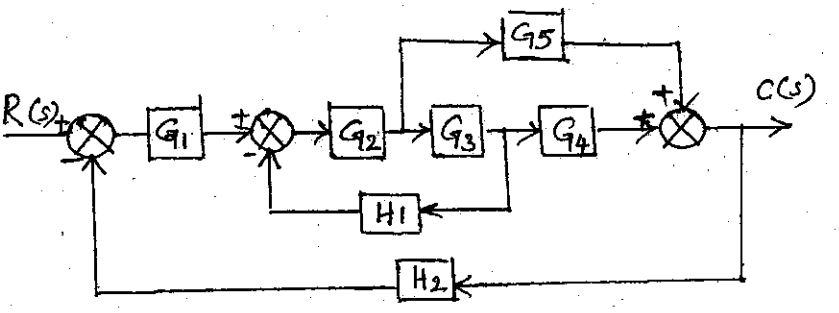
(Common for 1999 & 2002 Schemes)

Time: 3 Hours Maximum Marks: 100

I. a. Find the transfer function relating displacement y and x for a mechanical system shown below. (10)

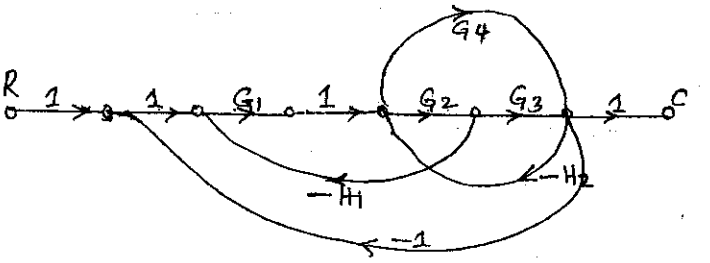



b. Using the block diagram reduction technique reduce the system to simplest possible form and find the transfer function. (10)




**OR**

II. a. Obtain the transfer function using Mason's gain formula. (12)




b. Solve the differential equation using Laplace transform method.

$\frac{d^2y}{dt^2}+3\frac{dy}{dt}+2y=t$. The initial conditions are $y'(0)=1$ and $y(0)=1$. (8)

III. a. Define rise time, peak time and maximum over shoot. Derive the expression for the above for a 2nd order system subjected to step input. (12)

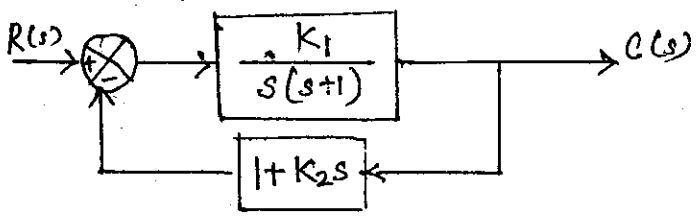
b. Determine the error constants and static error for a system with

$$G(s)=\frac{1}{s(s+1)(s+10)}, H(s)=(s+2).$$ (8)

**OR**

*(Turn over)*

IV. a. For the given system find the value of $K_1$ and $K_2$ for maximum overshoot of 0.2 and peak time of 1 second. (10)




b. Determine the stability of a system having characteristic equation.

$$s^6 + s^5 + 5s^4 + 3s^3 + 2s^2 - 4s - 8 = 0.$$ (10)

V. a. A feed back control system is described by

$$G(s) = \frac{10}{s(1+0.2s)(1+0.01s)}, H(s) = 1$$

Construct the Bode plot and determine the stability of the closed loop system. (14)

b. Define the terms gain margin and phase margin. (6)

**OR**

VI. a. Construct the Nyquist plot for a unity feed back control system whose open loop transfer function is $G(s)H(s) = \frac{K}{s(s^2+2s+2)}$. Find maximum value of K for which the system is stable. (14)

b. What are the main frequency domain specifications? (6)

VII. a. Briefly discuss different compensation networks used in control systems. (10)

b. Describe the design of a lag compensator in frequency domain. (10)

**OR**

VIII. a. Obtain the root locus diagram for a unity feedback system with open loop transfer function $G(s) = \frac{K}{s(s^2+6s+10)}$. (14)

b. List the properties of root locus. (6)

IX. a. Obtain the state space representation of the transfer function.

$\frac{C(s)}{R(s)} = \frac{1}{s^2+2s+3}$. Draw its block diagram also. (8)

b. Find the state transition matrix $\varphi(t)$ of the system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & -3 \\ -2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$ (12)

**OR**

X. Write notes on

(i) Seromotor (7)

(ii) Tachogenerator (7)

(iii) Magnetic amplifier (6)

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