B. Tech Degree VI Semester Examination, April 2010

CS/EC/EB/EI 605 CONTROL SYSTEM ENGINEERING

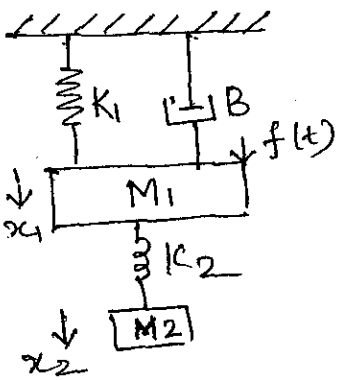
(2002 Scheme)

Time : 3 Hours Maximum Marks : 100

I. (a) Find inverse Laplace transform of the function $F(s)=\dfrac{10}{(s+4)(s+2)^3}$. (8)

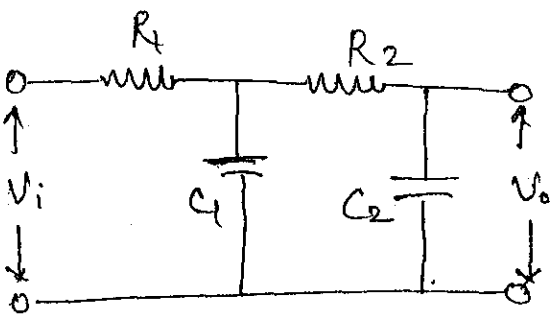
(b) Define transfer function and obtain the closed loop transfer function of a control system. (6)

(c) Draw the mechanical network diagram and force voltage analogous circuit for the given system. (6)

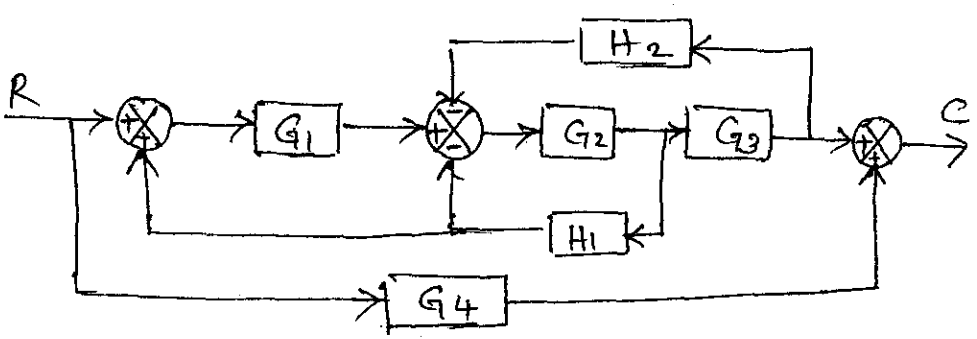


OR

II. (a) Obtain the transfer function of the given network. (10)



(b) Obtain the transfer function for the block diagram. (10)



III. (a) What are the standard test signals? Represent them in time domain and 's' domain. (4)

(b) Derive the unit step response of a first order system. (6)

(c) A unity feed back control system has an open loop transfer function $G(s)=10/s(s+2)$. Find the rise time, percentage overshoot and peak time. (10)

OR

(Turn Over)

IV. (a) What are the effects of PI and PD controller on system performance? (4)

(b) A unity feedback system has open loop transfer function of $G(s)=\frac{10}{(s+1)(s+2)}$.

Determine the steady state error for unit step input. (6)

(c) The characteristic equation of a feedback control system is $s^3+3ks^2+(k+2)s+4=0$. Determine the range of k for which the system is stable. (10)

V. (a) What is Nichols chart? How closed loop frequency response is determined using Nichols chart? (6)

(b) A unity feedback system is describe by $G(s)=\frac{10}{s(1+0.2s)(1+0.01s)}$.

Construct an asymptotic log-magnitude plot and an exact phase plot. From this determine (i) gain margin (ii) phase margin (iii) stability of the closed loop system. (14)

OR

VI. (a) State and explain Nyquist stability criterion. (8)

(b) The open loop transfer function of a closed loop system is

$G(s)\,H(s)=\frac{1}{s(1+2s)(1+s)}$. Comment on the stability of the system from the Nyquist plot. (12)

VII. (a) Explain the rules for construction of root locus. (8)

(b) A unity feedback control system has an open loop transfer function

$G(s)=\frac{K}{s(s^2+4s+13)}$. Sketch the root locus. (12)

OR

VIII. (a) Derive the transfer function for an electrical lag compensator. Draw the Bode plot and pole-zero plot of the same compensator. (10)

(b) List the steps involved in the design of lag compensator using Bode plot. (10)

IX. (a) A feedback system has a closed loop transfer function $\frac{10(s+4)}{s(s+1)(s+3)}$.

Construct the state model and its representation. (10)

(b) Obtain the state transition matrix of the given system :

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -1 & -1 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 1\\ -2\end{bmatrix}u(t) \quad (10)$$

OR

X. Write notes on :

(i) Servomotors (7)

(ii) Magnetic amplifier (7)

(iii) Adaptive control. (6)

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