PMM/KS/15/7082

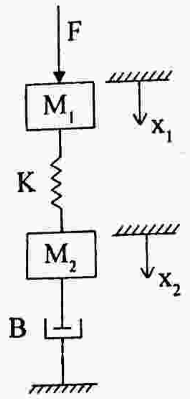
Faculty of Engineering & Technology

Sixth Semester B.E. (Mechanical Engg.) (C.B.S.) Examination

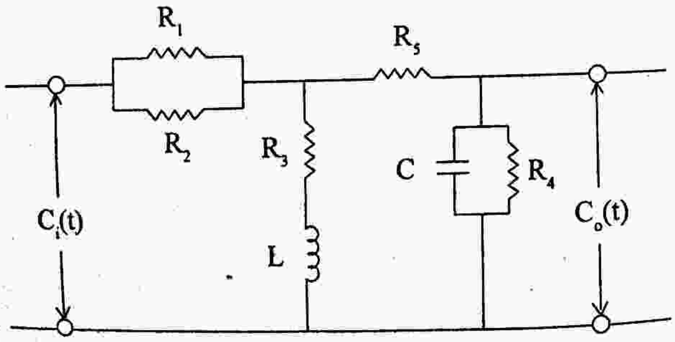
CONTROL SYSTEM ENGINEERING

Time : Three Hours] [Maximum Marks : 80

1. (a) Calculate $\frac{x_2}{x_1}, \frac{x_2}{F}, \frac{x_1}{F}$. 7



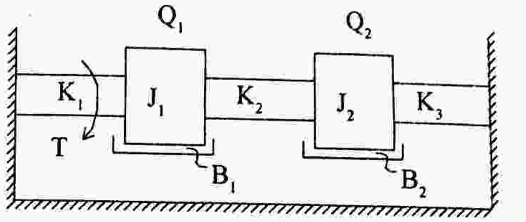
(b) Find $\frac{E_o(s)}{E_i(s)}$. 6



OR

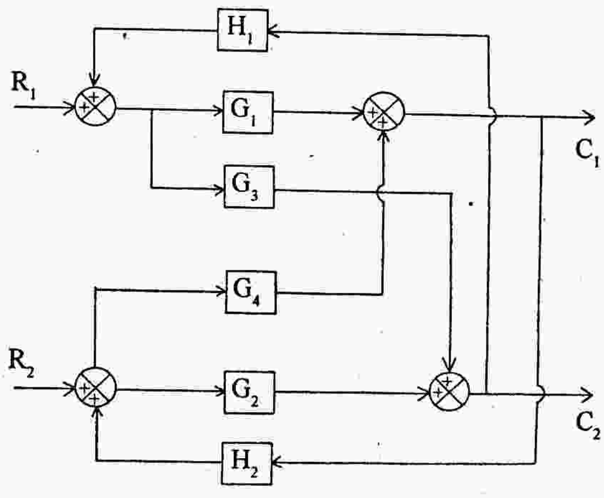
2. (a) Differentiate between close loop and open loop control systems. 5

(b)



Calculate Q_2/Q_1, for the system shown in Fig. Also calculate $\frac{Q_1}{T}$; $\frac{Q_2}{T}$. 8

3. Calculate $\frac{C_2}{R_1}$ and $\frac{C_1}{R_2}$ for the system given : 13



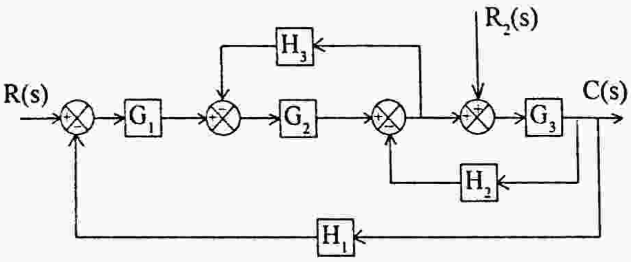
OR

4. Find the expression for $\frac{C}{R_1}, \frac{C}{R_2}$

where $R_1 \rightarrow$ Reference input signal

$R_2 \rightarrow$ Noise signal.

Calculate Signal to Noise ratio. Use signal flow graph method. 13



5. (a) Determine error constants and steady state error for input

$$r(t) = 10 + 5t + \frac{6}{2}t^2$$

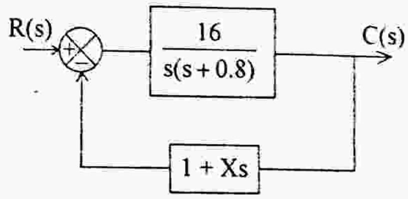
for a system having

$$G(s)H(s) = \frac{16}{s(s+8)(s+5)}.$$ 7

(b) Determine transient response specification for the system having $G(s)H(s) = \frac{16}{s(s+8)}$. 7

OR

6. (a) Find the value of 'X' such that $\xi = 0.5$. 7



(b) Differentiate between pneumatic and electric controllers. 7

7. (a) $G(s) = \frac{K}{s(s+6)(s+9)}$ of a unity feedback system.

Find the range of K so that system remains stable. It system shows sustained oscillations, find the frequency of oscillations. 8

(b) Explain in brief absolute, critical and marginally stable system. 5

OR

8. For a linear feedback control system having $G(s) = \frac{K(s+7)}{(s+2)}$ and the feedback $H(s) = \frac{1}{(s+6)}$, sketch the root locus when the gain K is changed from 0 to ∞. 13

9. Draw Bode plot for following function :

$$G(s)H(s) = \frac{25(s+2)e^{-0.3s}}{s^2(s+1)(s+10)}$$

Find gain margin and phase margin for the system to be stable. 13

OR

10. (a) Draw the polar plot and find Gain margin and Phase margin :

$$G(s)H(s) = \frac{K}{s(s+2)(s+3)}.$$ 8

(b) Determine OLTF of system from Bode gain plot as shown in Figure 10(b). 5

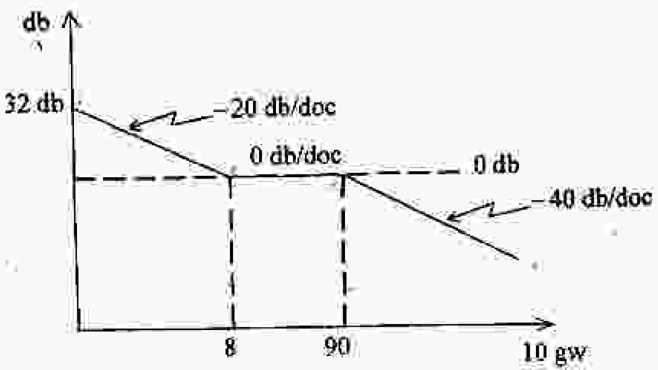


Figure 10(b)

11. (a) Give the state space representation for the system whose transfer function is given by

$$\frac{Y(s)}{U(s)} = \frac{10(s+4)}{s(s+1)(s+3)^2}.$$ 8

(b) Write short note on controllability and observability. 6

OR

12. (a) Find transfer function of the system defined by the following state space equations :

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -5 & -25 & -5.5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 25\\ -120\end{bmatrix}$$

and $y = \begin{bmatrix}1 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$. 8

(b) Write short note on phase lag-lead compensation. 6

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