

**Control System Engineering**

P. Pages : 4

Time : Three Hours

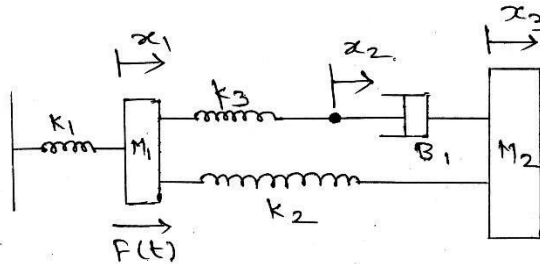


**NJR/KS/18/4535**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Assume suitable data whenever necessary.
  9. Illustrate your answers whenever necessary with the help of neat sketches.
  10. Simple Graph paper, Semilog paper and Polar Graph Paper.

1. a)



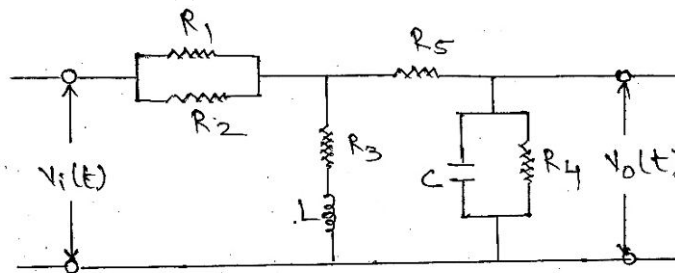
7

Find  $\frac{x_2(s)}{F(s)}$

b)

Find the transfer function  $\frac{V_0(s)}{V_i(t)}$

7



**OR**

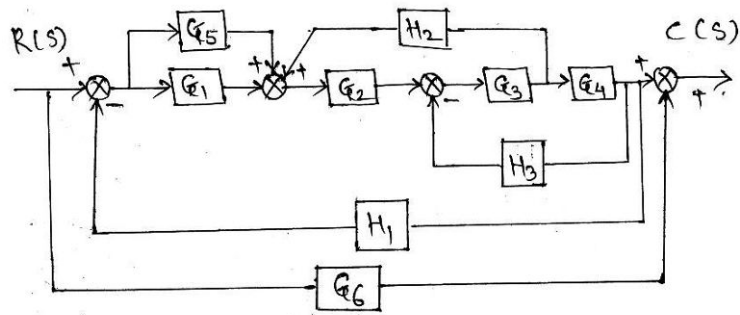
2. a) Explain the servo-mechanism. Give its advantages, disadvantages & applications.

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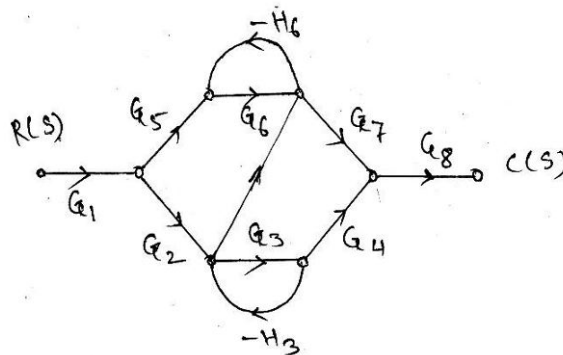
b) What is control system. Give the classification of control systems.

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3. a) Find  $\frac{C(s)}{R(s)}$  for the given block diagram. 7

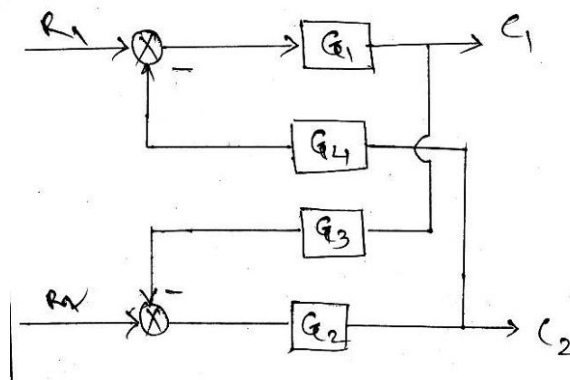


- b) Obtain the transfer function  $\frac{C(s)}{R(s)}$  from the following signal flow graph. 6



OR

4. a) Obtain the expression for  $C_1$  &  $C_2$  for the given multiple input & multiple output system. 7



- b) Convert the following equations into the signal flow graph & find out its transfer function. 6  
 $Y_2 = G_1 Y_1 + G_3 Y_3$   
 $Y_3 = G_4 Y_1 + G_2 Y_2 + G_5 Y_3$   
 $Y_4 = G_6 Y_2 + G_7 Y_3$

5. a) Derive the expression for the first order system with unit ramp input. 7



b) Draw the polar plot for a given system

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

Find out its gain margin in db.

7

11. a) Explain the term controllability & observability.

6

b) Calculate the transfer function of given system having state space model

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$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix} V$$
$$y = [1 \quad 1] \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$

OR

12. a) Find out the controllability & observability of the system whose matrix is given by

8

$$A = \begin{bmatrix} 1 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & -2 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} \quad C = [1 \quad 0 \quad 0]$$

b) Explain lag-lead compensation.

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