B.E.(Power Engineering) Semester Fifth (C.B.S.)

Control Systems Engineering

P. Pages : 4 **KNT/KW/16/7367**

Time : Three Hours * 0 6 8 0 * 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. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data wherever necessary.
10. Illustrate your answers wherever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Explain with neat sketch Liquid level control system. **5**

b) Determine transfer function of the electrical network shown in Fig. 1 b. **8**

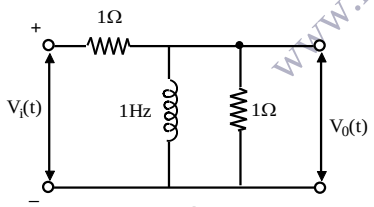


Fig. 1 b

OR

2. a) Explain with neat sketch position control of Robotic-manupulator. **5**

b) Determine transfer function $x_2(s)/f(s)$ of the translational mechanical system shown in fig. 2 b. **8**

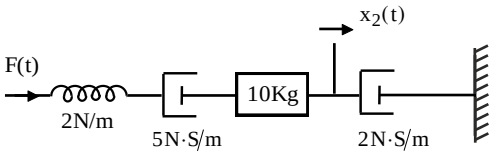
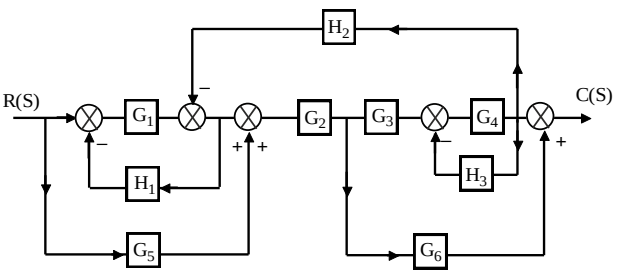


Fig. 2b

3. a) Determine $T \circ f \circ C(S) / R(S)$ of the system represented by block diagram algebra Ref fig.3 a. **7**



b) Convert the signal flow graph shown in fig. 3b in to block diagram and determine $T \circ f \circ$ C(S)/R(S) by Block diagram algebra. **7**

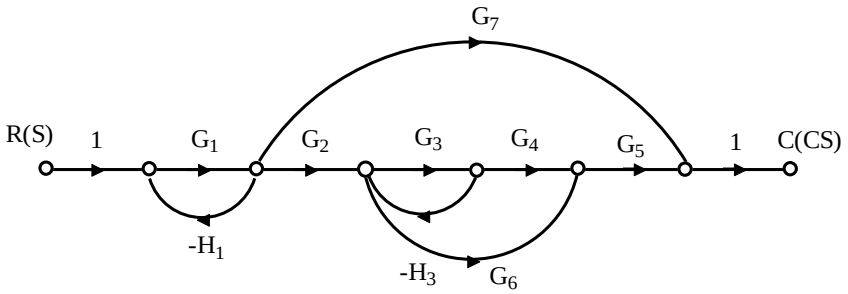


Fig. 3 b

OR

4. a) Construct the signal flow graph for the electrical network shown in fig. 4a. Take v_1 as input node and v_3 as output node. **7**

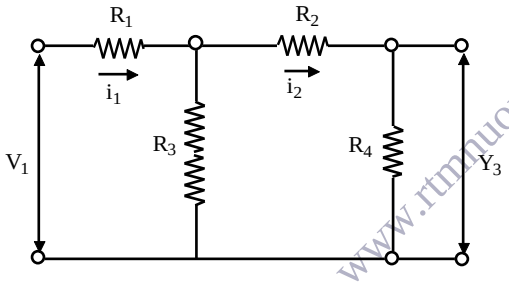
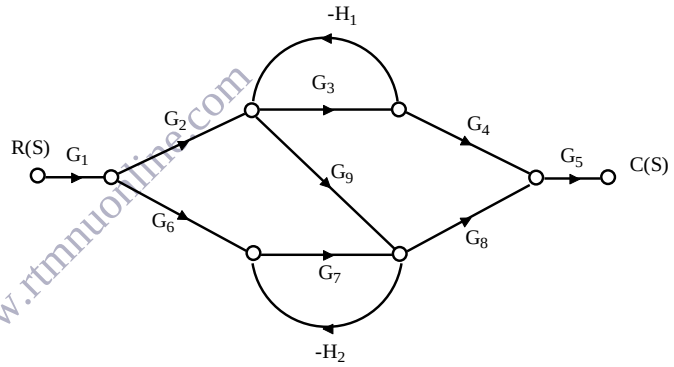


Fig. 4 a

b) Find $T \circ f \circ$ of SFG using mason's Gain formula Ref. Fig. 4b. **7**



5. a) Explain PID controllers and its applications. **5**

b) For unity feed-back control system having $G(S) = \dfrac{20}{S(1+4S)(1+S)}$ **8**

Determine:

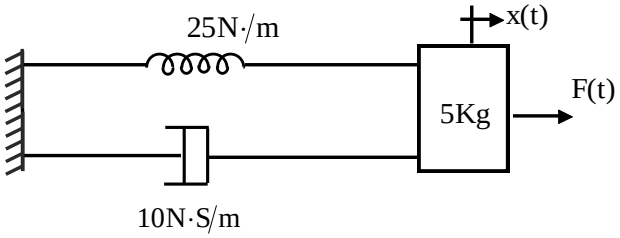
i) Static error coefficients.

ii) Steady state error it input $r(t) = 2 + 4t + t^2/2$

OR

6. a) System has $G(S) = \frac{K}{S(1+ST)}$ with unity feed-back where 'K' and 'T' are constants. The overshoot is to be reduced from 75% to 25%. Find the factor by which 'K' should be multiplied. **7**

b) Determine transient response specifications of the translational mechanical system shown in fig. 6 (b) **6**



7. a) Find the range of gain 'K' for stability of unity feed-back system having **8**

$G(S) = \frac{K(1+S)^2}{S^3}$

b) Explain absolute and relative stability of control system. **5**

OR

8. Sketch Root Locus for unity feed-back system having $G(S) \cdot H(S) = \frac{K}{S(S+2)(S+5)}$ **13**

Determine value of 'K' at critical damping.

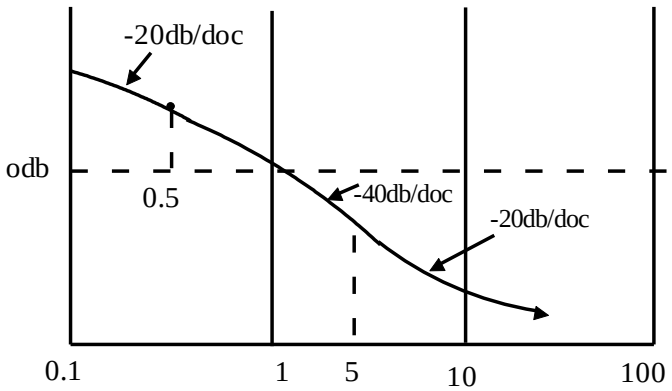
9. Draw Bode plot for unity feed-back system having $G(S) = \frac{400(S+2)}{S^2(S+10)(S+40)}$ Determine **14**

GM, PM and comment on system stability.

OR

10. a) Draw polar plot for system having $GH(S) = \frac{250}{S(S+2)(S+4)(S+8)}$ **7**

b) Determine open loop transfer function from the Bode magnitude plot shown in Fig. 10 b. **7**



11. Construct state model for the system having transfer function. **13**

$$\frac{Y(S)}{U(S)} = \frac{2}{S^3 + 6S^2 + 11S + 6}$$

Also, test for controllability and observability of the system.

12. a) Determine transfer function for the system given as **8**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \mu(t) \quad y = [1,\ 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

b) Explain lead and Lag compensation **5**

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