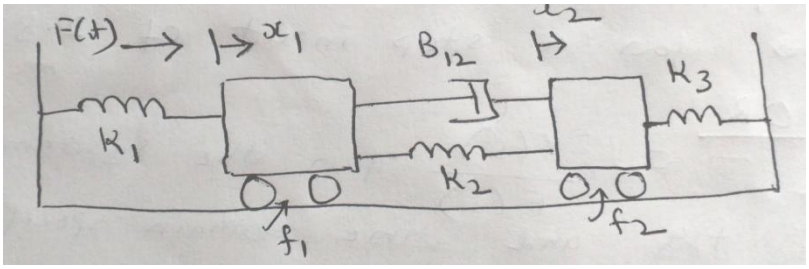
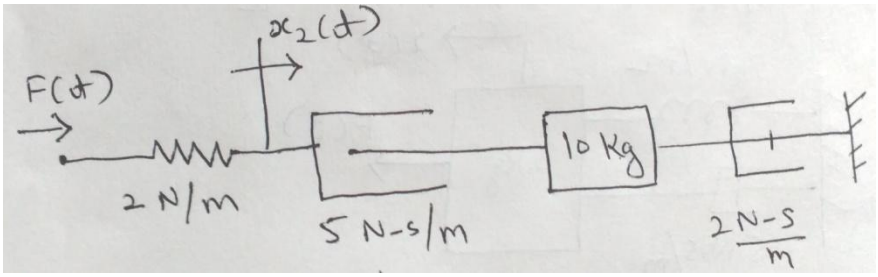
1. $\frac{X_2(s)}{F\ (s)} = ?$

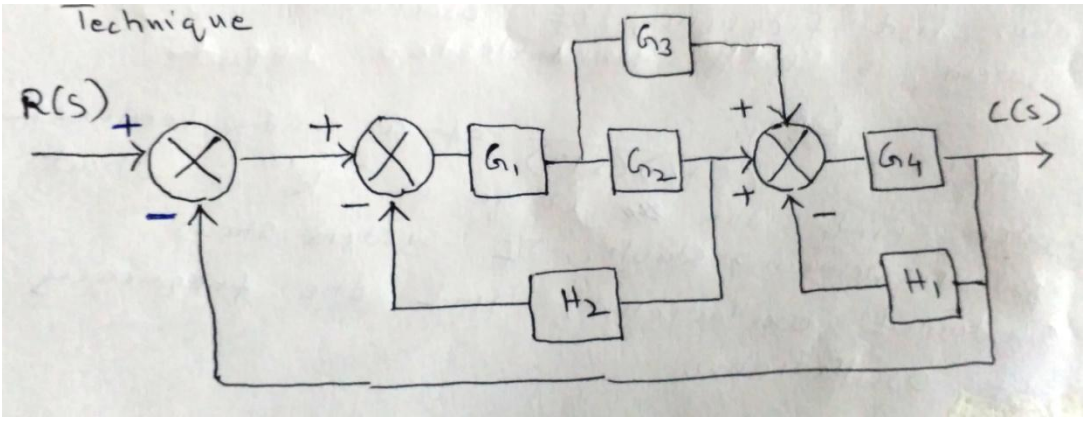


2.

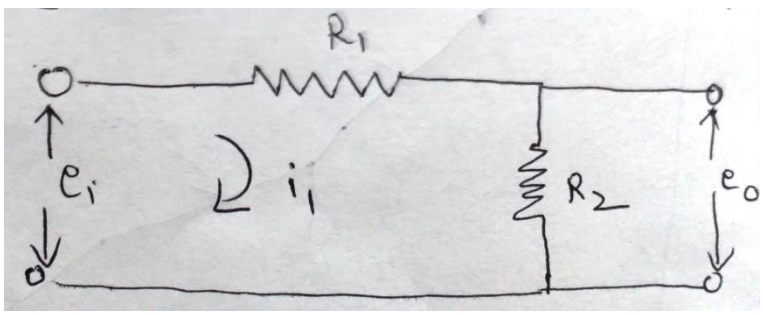


Write equation of motion of translational system as shown above and determine Transfer function.

3. Find $\frac{C(s)}{R\ (s)} = ?$ By using block reduction Technique.



4. Draw signal flow graph for the electrical network as shown and determine T.F. using Muson's Guin formula.

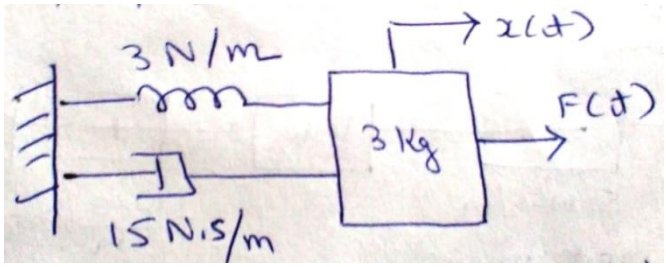


5. A system is described as,

$$\frac{d^2y}{dt^2} + 10\,\frac{dy}{dt} + 49\,y = 100\,x$$

Find response, maximum output and all time domain specifications for a step input of 2.85 units.

6. Determine T.F. $\frac{X(s)}{F(s)}$ from the system shown in following fig. and time domain specifications ,
   (i) ω_n , ξ, % M_P , T_s , T_p , and T_d .



7. Using Routh's Criterion determine range of gain "K" for stability of system having ,

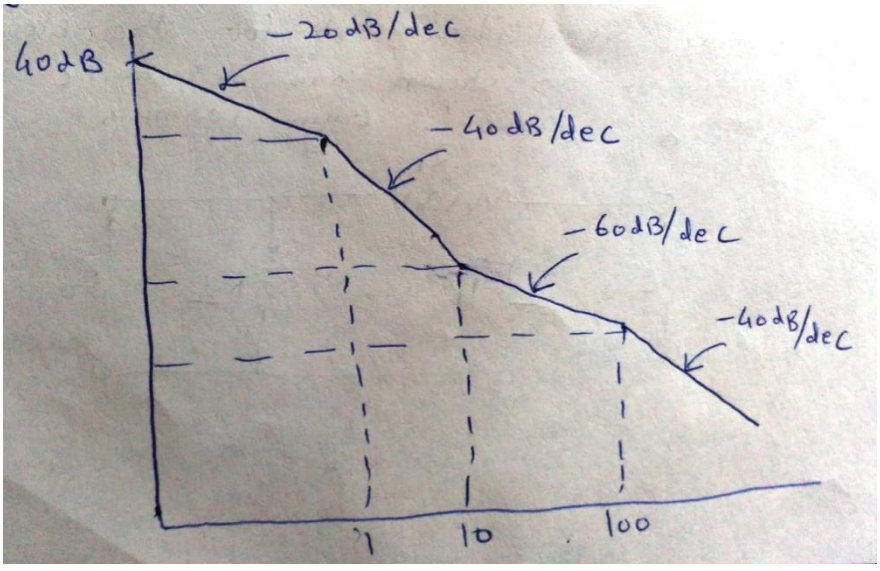
$$G(s)\,H(S) = \frac{K}{(S+1)^3 + (S+4)}$$

   Also, find frequency of oscillations when the system is marginally stable.

8. $G(s) = \frac{K}{S(S+6)\,(S+9)}$ of a unity feedback system. Find the range of "k"
   So that system remains stable. If system shows sustained oscillations,
   Find the frequency of oscillations.

9. Determine T.F. of the system as shown,

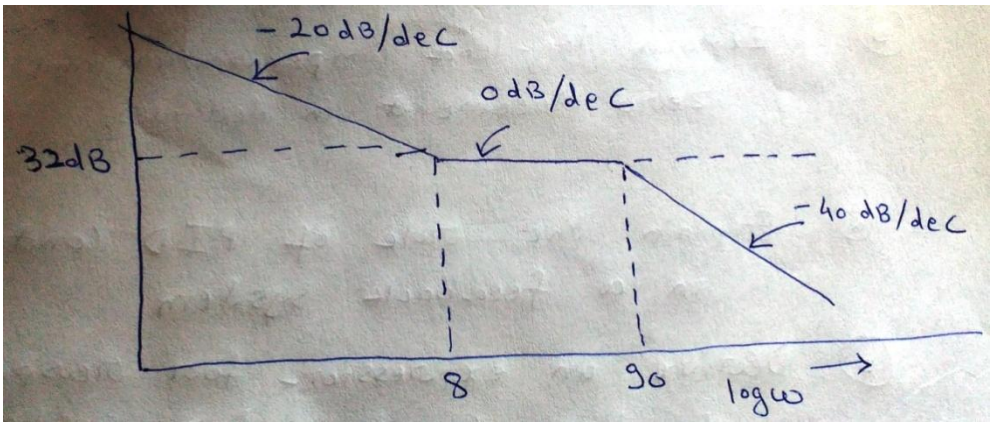
(a)



(b) Draw polar plot of $G(s)H(s) = \frac{100}{(S+2)\,(S+4)(S+8)}$

OR

10. Determine open loop transfer function of system ,
    (a) From bode gain plot,



    (b) Draw the polar plot for the system equation,

$$G(s)\,H(s) = \frac{K}{S(S+2)\,(S+3)}$$

11. (a) Explain the term controllability and observability.

    (b) Give the state space representation for the system whose T.F. is given by,

$$\frac{y\,(s)}{u\,(s)} = \frac{2}{s^4 + 1.55^3 + 2.55 + 1}$$

OR

12. Consider the following plan of states- space representation. Examine controllability and observability. Also, convert state space equation into transfer function.

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

13. Give the state space representation for the system whose T.F. is given by,
    (a) $\frac{y\,(s)}{u\,(s)} = \frac{2}{s^3+6s^2+11s+6}$
    (b) Explain lag-lend compensation and pole zero placement in details.

14. (a) Explain the role of PID controller in a feedback system.

    (b) Derive an expression for response of the first order system with step input.

15. (a) How many poles of the system having following characteristics equation lie in right-half, left half and jω- axis of s-plane.

$$S^5 + 3S^4 + 5S^3 + 4S^2 + S + 3 = 0$$

    (b) Write short notes on,
        i. Stability Criterion
        ii. Lead – lag compensation