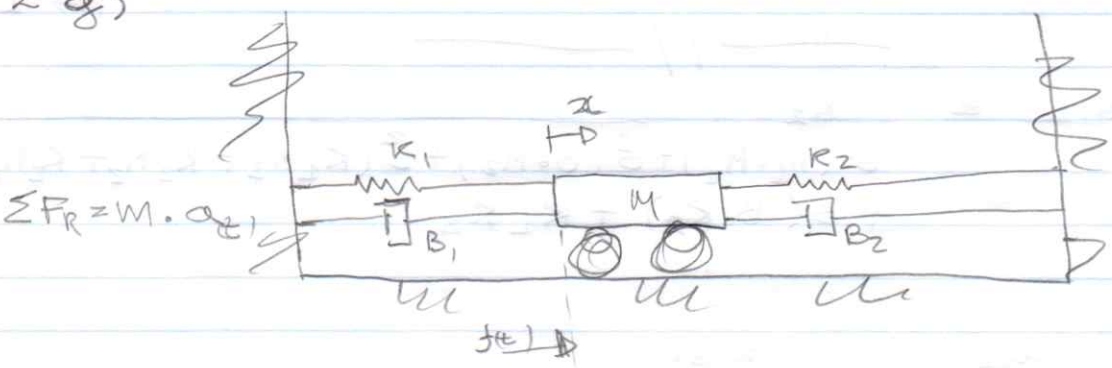
2 q)



$\Sigma F_R = M \cdot a_{(t)}$

$$\mathcal{L}\begin{cases} f(t) - K_1 x_{(t)} - K_2 x_{(t)} - B_1 \dot{x}_{(t)} - B_2 \dot{x}_{(t)} = M \cdot \ddot{x}_{(t)} \end{cases}$$

$$F(s) = K_1 X(s) + K_2 X(s) + sB_1 X(s) + sB_2 X(s) + s^2 M X(s)$$

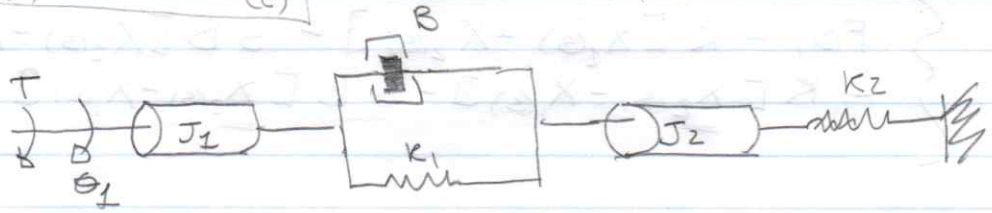
$$F(s) = [s^2 M + sB_1 + sB_2 + K_1 + K_2] X(s)$$

$$\frac{X(s)}{F(s)} = \frac{1}{s^2 M + s(B_1 + B_2) + K_1 + K_2}$$

Rotacão

$$\Sigma T_{(t)} = J \gamma_{(t)} \qquad [N.m]$$

7 q)



$$FT = \frac{\Theta_{2(s)}}{T(s)}$$

$$\begin{cases} \Sigma T_1 = J_1 \gamma_{(t)} \\ \Sigma T_2 = J_2 \gamma_{(t)} \end{cases} \quad \begin{cases} T - K_1(\theta_{1(t)} - \theta_{2(t)}) - B(\dot{\theta}_{1(t)} - \dot{\theta}_{2(t)}) = J_1 \ddot{\theta}_{1(t)} \\ -K_1[\theta_{2(t)} - \theta_{1(t)}] - B[\dot{\theta}_{2(t)} - \dot{\theta}_{1(t)}] - K_2 \theta_{2(t)} = J_2 \ddot{\theta}_{2(t)} \end{cases}$$

$\mathcal{L}$

$$\begin{cases} T(s) - K_1[\theta_{1(s)} - \theta_{2(s)}] - sB[\theta_{1(s)} - \theta_{2(s)}] = s^2 J_1 \theta_{1(s)} \\ -K_1[\theta_{2(s)} - \theta_{1(s)}] - sB[\theta_{2(s)} - \theta_{1(s)}] = s^2 J_2 \theta_{2(s)} \end{cases}$$