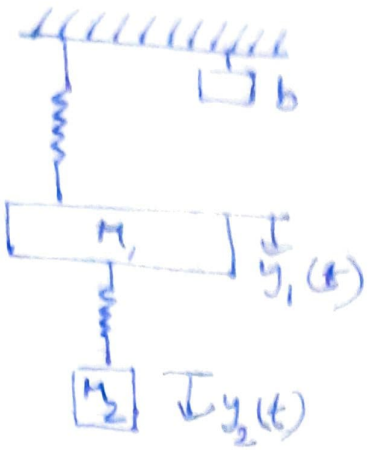
Question 1:



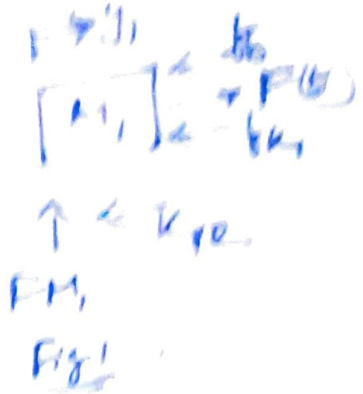


Fig 1

Given, $M_1 = 100$, $K_1 = 50$, $b = 50$ M_2 & K_2 = ?

$$F_{M_1} = M_1 \frac{d^2 y_1}{dt^2}$$

$$f_b = \frac{b\, dy_1}{dt}$$

$$f_{K_1} = K_1 y_1$$

$$\boxed{f_{K_2} = K_{12}(y_1 - y_2)}$$

$$F(t) = \frac{M_1 d^2 y_1}{dt^2} + b\frac{dy_1}{dt} + K_1 y_1 + K_{12}(y_1 - y_2)$$ [Newton's 2nd Law of Motion on M_1] ← (1)

$$F_{M_2} = M_2 \frac{d^2 y_2}{dt^2}$$

$$\boxed{F_{K_{12}} = K_{12}(y_2 - y_1)}$$

Newton's 2nd law of Motion on M_2,

$$M_2 \frac{d^2 y_2}{dt^2} + K_{12}(y_2 - y_1) = 0$$

$$M_2 \frac{d^2 y_2}{dt^2} + K_{12} y_2 = K_{12} y_1 \quad \text{— (2)}$$

$$\begin{bmatrix} M_1 s^2 + bs + K_1 + K_2 & -K_{12} \\ -K_{12} & M_2 s^2 + K_{12} \end{bmatrix} \begin{bmatrix} Y_1(s) \\ Y_2(s) \end{bmatrix} = \begin{bmatrix} F(s) \\ 0 \end{bmatrix}$$