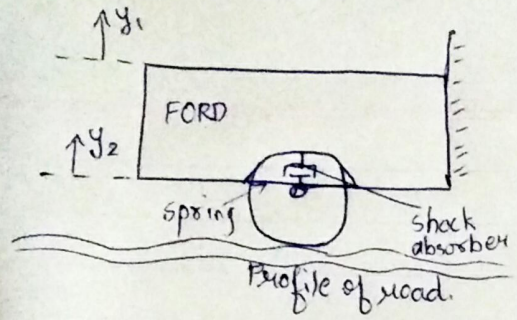
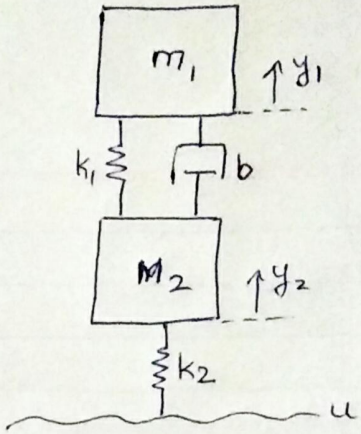
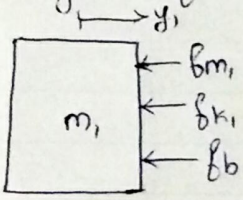
Problem 2:

Derivation:





Force body diagram of Mass m_1.



$$f_{m_1} = m_1 \frac{d^2y_1}{dt^2}$$

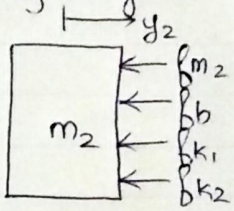
$$f_b = b\left(\frac{dy_1}{dt} - \frac{dy_2}{dt}\right)$$

$$f_{k_1} = k_1(y_1 - y_2)$$

$$\therefore 0 = m_1\frac{d^2y_1}{dt^2} + b\left(\frac{dy_1}{dt} - \frac{dy_2}{dt}\right) + k_1(y_1 - y_2)$$

$$m_1\frac{d^2y_1}{dt^2} = -b\left(\frac{dy_1}{dt} - \frac{dy_2}{dt}\right) - k_1(y_1 - y_2)$$

Force body diagram of Mass, m_2



$$f_{m_2} = m_2 \frac{d^2y_2}{dt^2}$$

$$f_b = b\left(\frac{dy_2}{dt} - \frac{dy_1}{dt}\right)$$

$$f_{k_1} = k_1(y_2 - y_1)$$

$$f_{k_2} = k_2(y_2 - u)$$

$$\therefore 0 = m_2\frac{d^2y_2}{dt^2} + b\left(\frac{dy_2}{dt} - \frac{dy_1}{dt}\right) + k_1(y_2 - y_1) + k_2(y_2 - u)$$

$$\therefore m_2\frac{d^2y_2}{dt^2} = -b\left(\frac{dy_2}{dt} - \frac{dy_1}{dt}\right) - k_1(y_2 - y_1) - k(y_2 - u)$$