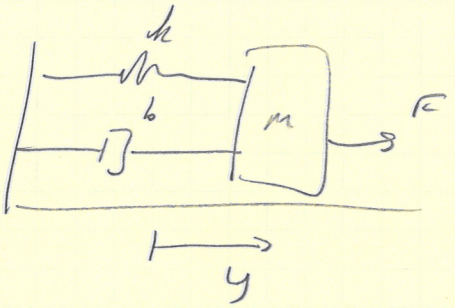
Solution

IV.3



Generalized Coordinates : $q_1 = y$

Generalized Forces on y : $z_1 = F - b\dot{y}$

Kinetic Energy :

$$K = \tfrac{1}{2} m\dot{y}^2$$

Potential Energy

$$P = \tfrac{1}{2} k y^2$$

Lagrangian

$$L = K - P = \tfrac{1}{2} m\dot{y}^2 - \tfrac{1}{2} k y^2$$

Euler Lagrange equations :

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{y}}\right) - \frac{\partial L}{\partial y} = z_1$$

where

$$\frac{\partial L}{\partial \dot{y}} = m\dot{y}$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{y}}\right) = m\ddot{y}$$

$$\frac{\partial L}{\partial y} = -ky$$

So the equations of motion are

$$\boxed{m\ddot{y} + ky = F - b\dot{y}}$$