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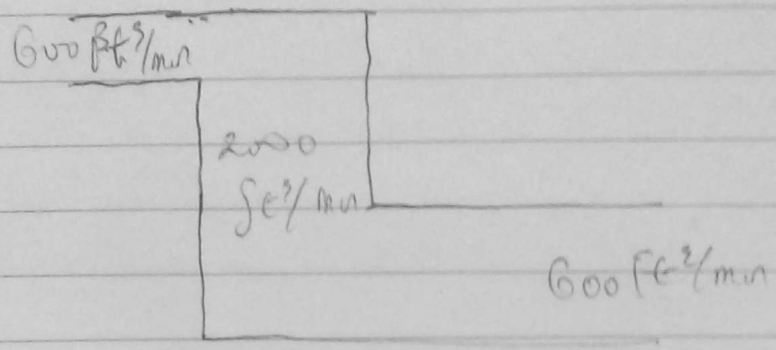
Matric No : 16/ENG06/020
Dept : Mechanical



$$\frac{dy}{dt} = y_{in} - y_{out}$$

$$y_{in} = 600$$

$$y_{out} = \frac{600}{2000} = 0.03y$$

$$dy/dt = 600 - 0.02y$$

$$dy/dt = -0.03(y - 20{,}000)$$

$$\int dy/(y - 20{,}000) = \int -0.03t$$

$$\ln(y - 20{,}000) = -0.03t + C$$

$$y - 20{,}000 = e^{-0.03t} + C$$

$$y - 20{,}000 = y - e^{-0.03t}$$

$$y = ye^{-0.03t} + 20{,}000$$

a) At $t = 0$; $y = 0$

$$y = y_0 \cdot e^{-0.03t} + 20{,}000$$

$$0 = y_0 e^{-0.03(0)} + 20{,}000$$

$$y_0 = -20{,}000$$

$$y = 20{,}000\, e^{-0.03t} + 2000$$

b) $90\% \times 20{,}000 = 18{,}000$

$$y = 18{,}000$$

$$18{,}000 = -20060\, e^{-0.03t} + 20{,}000$$

$$18000 - 20{,}000 = -20{,}000\, e^{-0.03t}$$

$$0.1 = e^{-0.03t}$$

$$\ln(0.1) = -0.03t \quad t = 2.30/0.03 \quad t = 76.8 \text{ mn.}$$