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MATRIC NO: 17fene906/049

Dept: Mechanical Engineering

Eng 282 Assignment 5

1) What is mathematical modeling

Mathematical modeling can be defined as a description of system using mathematical concept and languages. Mathematical models are used in the natural sciences and engr disciplines as well as the science

b) Differentiating

Use of balance laws

$$c) T_{(0)} = 10^{\circ}\text{C}$$

$$T_{(B)} = 25^{\circ}\text{C}$$

$$\text{Actual temp} = 25^{\circ}\text{C} = T_A$$

$$\frac{dT}{dt} = k(T - T_A)$$

$$dT = k(T - T_A) dt$$

$$\frac{dT}{T - T_A} = k dt$$

Integrating both sides

$$\ln(T - T_A) = kt + c$$

$$T - T_A = e^{kt} + e^c$$

Let e^c be A

$$T - T_A = e^{kt} A$$

$$T - T_A = A e^{kt}$$

$$T = A e^{kt} + T_A$$

When $T = 10$

$$10 = A e^{k(0)} + 25$$

$$10 = A + 25$$

$$A = 10 - 25$$

$$= -15$$

$$T = 25 - 15e^{kt}$$

$$\text{At } t(5) \text{ and } T = 20$$

$$20 - 25 = 15e^{5k}$$

$$15e^{5k} - 5 = -15e^{5k}$$

$$15e^{5k} = 25$$

$$e^{5k} = \frac{25}{15}$$

$$e^{5k} = 0.8333$$

$$e^{5k} = \ln 0.8333$$

$$5k = -1.0987$$

$$k = \frac{-1.0987}{5}$$

$$k = 0.22$$

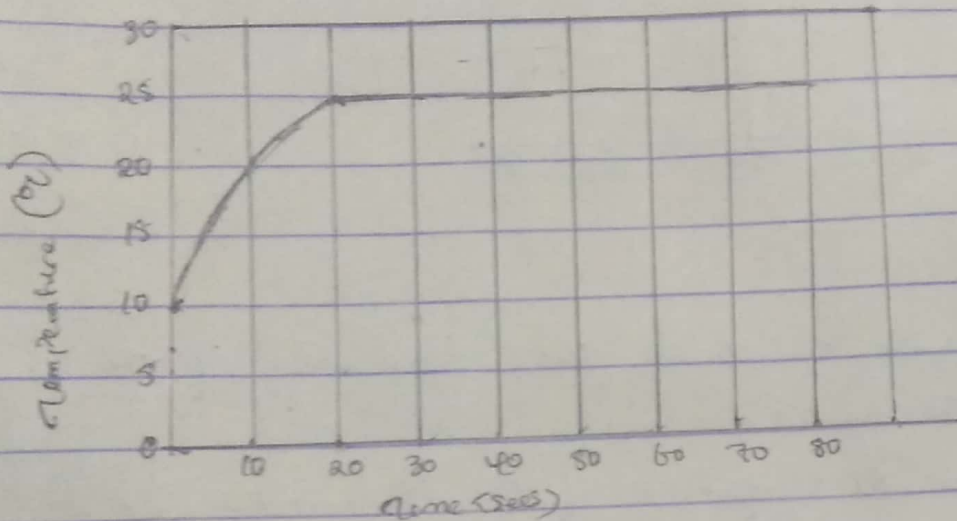
$$[T(t) = 25 - 15e^{-0.22t}] - \text{model equation}$$

Using Microsoft Excel

- Picking a cell Insert (6)
- Picking another cell Insert (7)
- Under the already labelled cell (6)
- Insert a value at in an empty cell
- Click on Series
- Insert a step value of 1
- Change the Series into columns
- Insert a step value of 60
- Under the already labelled cell (7)
- Pick a cell
- Insert $A = 25(15e^{(-0.22)t})$

- Auto fit
- Go to insert
- Plot a graph of choice
- Label the graph

Output



Using MATLAB

Command window

Clear

clc

Close all

t = 0:1:60

T = 25 - 15 exp(-0.2t)

plot(t, T)

grid on

grid minor

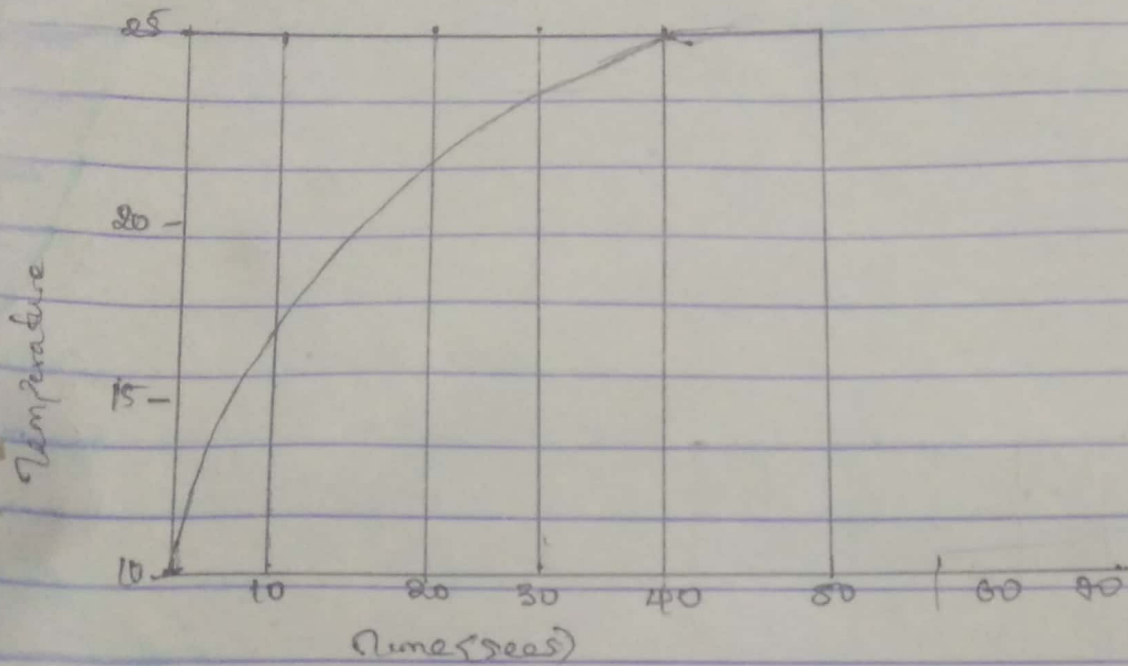
x label ('Time (secs)')

y label ('Temperature')

grid on

grid minor

Output



1. Using grid dynamic response the steady state temperature of the system would be 25°C to 20m.s^{-1}
2. Using developed model can, the temperature of the thermometer at time will be 25°C