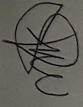


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17/ENG03/015



ENG 282 (Assignment V)

(a) Define mathematical modelling

Mathematical modelling is a mathematical representation of system and simulation of a system which involves solving the model and obtaining it's output. Variable for different values of it's input variable or as input variable is changed from one values to another.

(b) Methods of obtaining a model

- Differentiating
- use of balance law

(c) solution

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

$$T(5) = 20^\circ\text{C}$$

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

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

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

$$\ln(T - T_A)$$

Integrat both sides

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

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

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

let e^C be A

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

$$T - T_A = Ae^{kt}$$

$$T = Ae^{kt} + T_A$$

When $T = 10$

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

$$10 = A + 25$$

$$A = 10 - 25$$

$$A = 45 - 15$$

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

$$At \ t(5) = 20$$

$$20 = 25 - 15e$$

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

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

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

$$e^{5k} = 0.3333$$

$$5k = \ln 0.3333$$

$$5k = -1.0986$$

$$k = -0.22$$

$$T(t) = 25 - 15e^{-0.22t} \quad \text{--- Relating equation}$$

ii Using Microsoft Excel

- Pick a box insert 't'

- Pick another box insert 'T'

- Under the already labelled box 't'

- Insert a value of 0 in an empty box

- Go to

- Adjust Click on Series

- Insert a step value of 1

- Change the series in to Columns

- Insert a step value of 60

- Under the already labelled box

- Pick a box

$$\text{- Insert} = 25 - (15 * \text{EXP}(-0.22 * t2))$$

- Auto fill

- Go to Insert

- Pick a graph of choice

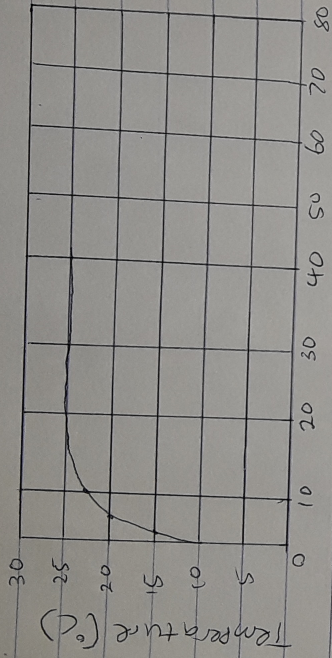
- Label the graph

Temperature

(ii)

(vi)

Output



using MATLAB

Command Window

Clear

clc

close all

t = 0:1:60

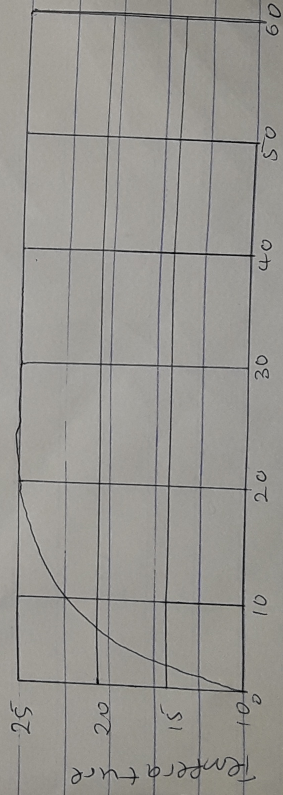
$$T = 25 - 15 * \exp(-0.22 * t)$$

Plot(t, T)

grid on

grid minor

Output



- (iv) Using Excel's dynamic response, the steady state temperature of the system would be 25°C at
- (v) Using the developed model equation, the temperature of the thermometer at t will be 25°C