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Computer Engineering

a.) Mathematical modelling is a mathematical representation of system and simulation of a system which makes study the model and obtaining its output variable for different values of input variable for different values of its input variable or as input variable or as input variable is changed from one values to another

b.) methods of obtaining a model

c.) Balance law - drying problems

Torricelli's law - leakage problems

c.)

Combustion

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

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

$$\text{Actual temperature} = 25^{\circ}C = T_h$$

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

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

$$\frac{dT}{(T - T_h)} = k dt + c$$

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

$$T - T_h = e^{kt} + e^c \quad \text{let } e^c = A$$

$$= e^c = A$$

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

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

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

when

$$T = 10$$

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

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

$$u(t=5) = 20$$

$$20 = 25 - 15e^{k5}$$

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

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

$$e^{5k} = 5/15 = 0.3333$$

$$5k = \ln 0.3333$$

$$5k = -1.0986$$

$$k = -1.0986/5$$

$$= -0.22$$

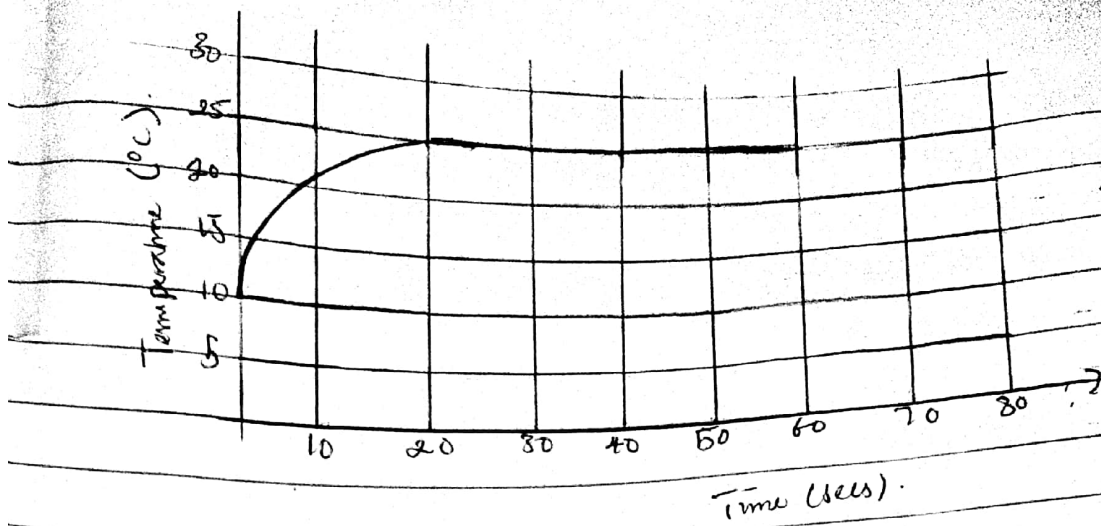
$$U(t) = 25 - 15e^{-0.22t}$$

relating the equation

Using Microsoft Excel:

- Pick a box and insert 't'
- Put another box insert '1'
- Under the already labelled box 't'
- insert a name of 0 in an empty box
- insert a step value of 4
- Change the Series in to Column.
- insert a stop value of 65
- Under the already labelled box 2. 't'
- put a box.
- insert $t = 25 - (15 \cdot \exp(-0.22 \cdot A_2))$
- Auto fill
- Go to insert
- put a graph of choice (X and Y scatter preferably).
- Label the graph.

Output:



Using MATLAB.

1) → Command window

2) → clear

3) → cli

4) → close all

5) → $t = 0 : 1 : 80$

6) → $T = 25 - 15 \cdot \exp(-0.022 \cdot t)$

7) → `plot(t, T)`

8) → grid on

9) → grid minor

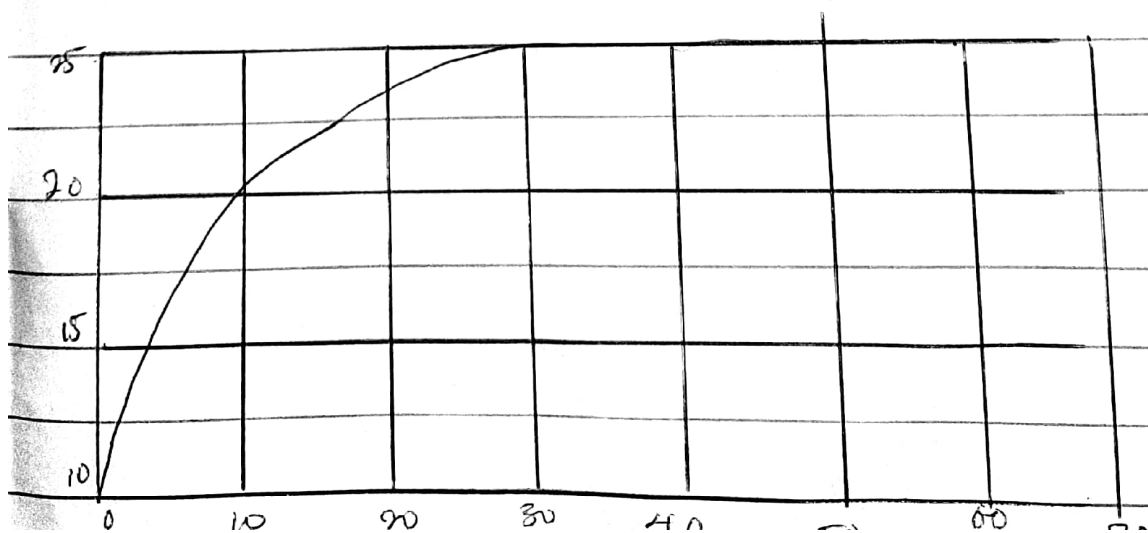
10) → xlabel('Time (secs)')

11) → ylabel('Temperature')

12) → grid on

13) → grid minor

Output.



Using the dynamic response, the steady state temperature of the system would be 25°C at 20 mm/s .

v) Using the developed model equation, the temperature of the thermometer at $t \rightarrow \infty$ will be 25°C .