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1 ENG 282 Assignment Solution

a). Define Mathematical modelling

Mathematical modelling is a mathematical representation of a System and Simulation of a System which Involves Solving the model and Obtaining its Output Variable for dfferent Values of its 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:

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

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

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

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

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

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

Integrating both Sides

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

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

let e^c be A.

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

$T - T_A = Ae^{kt}$

$T = Ae^{kt} + T_A$

when $T = 10$

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

$10 = A + 25$

$A = 10 - 25$

$A = -15$

$25 - 15e^{kt}$

At $t(5) = 20$

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

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

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

$15e^{5k} = 5$

$e^{5k} = 0.3333$

$5k = \ln 0.3333$

$5k = -1.0986$

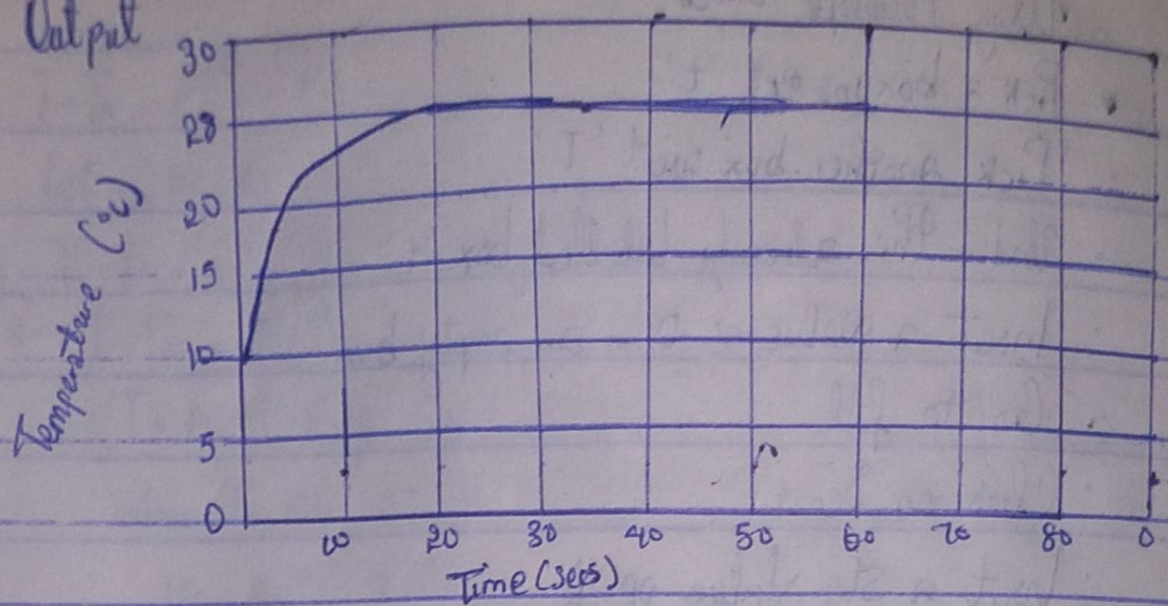
$k = -0.22$

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

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 fill
- Click on Series
- Insert a step value of 1
- Change the Series in to Columns
- Insert a Stop Value of 60
- Under the already labelled box 2 insert 'i'
- Pick a box
- Insert $=25-(15*\text{Exp}(-0.2t*At))$
- Auto fill
- Go to Insert
- Pick a graph of choice
- Label the graph

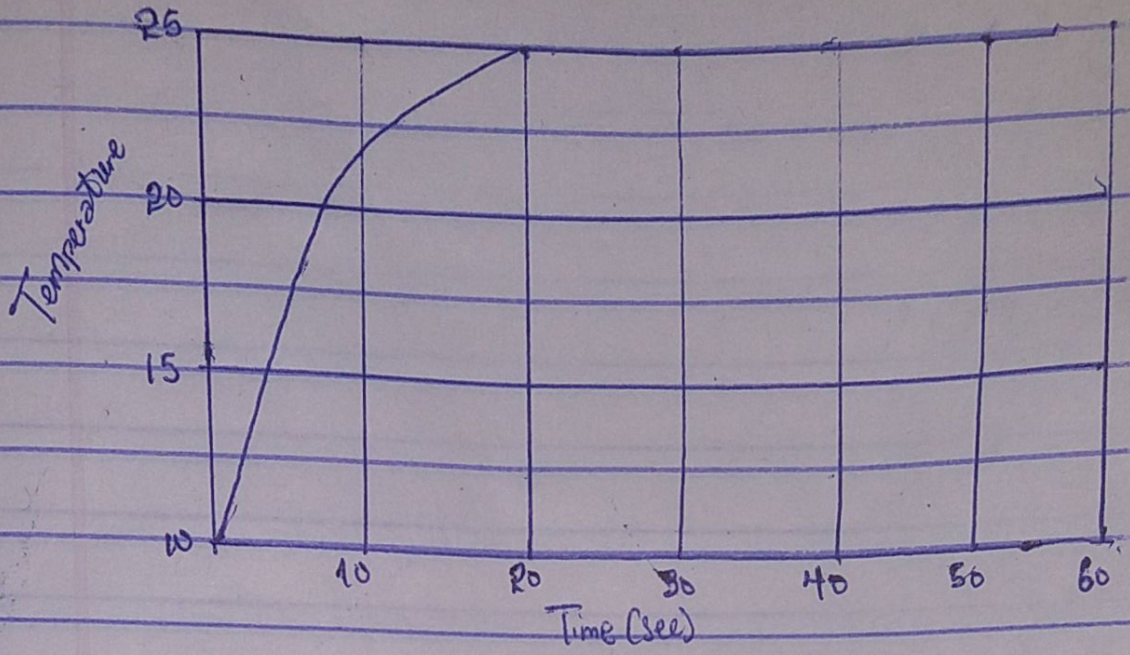
Output



Using MATLAB

```
Command Window
Clear
Clc
Close all
t = 0:1:60
T = 25-15*exp(-0.22*t)
Plot(t,T)
grid On
grid minor
X label('Time(secs)')
Y label('Temperature')
grid On
grid minor
```

Output:



iv) Using Excel's dynamic response the Steady State temperature of the System would be 25°C at 20 minutes

v) Using the developed model ~~System~~ equation, the temperature of the thermometer at t will be 25°C