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17/ENG04/076
ELECT/ELECT

ENG 282 ASSIGNMENT V

(a) Define Mathematical modelling

This can be defined as a mathematical representation of a system and simulation of a system, which involves solving model and obtaining it's output variable for different values of it's input variables or as input variable is changed from one value to another.

(b) Methods of obtaining a model;
- Differentiation
- Use of Balance laws

(c) Solution

$T_{(0)} = 100°c$

$T_{(5)} = 20°c$

Actual temp: $25°c = T_a$

$dt/dt = k(T - T_a)$

$dt/(T - T_a) = kdt$

integrate

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

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

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

Let e^c be A

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

$T - T_a = Ae^{kt}$

$T = Ae^{kt} + T_a$

where $T = 10$

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

$10 = A + 25$

$A = 10 - 25$

$A = -15$

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

At $t(5) = 20$

$20 = 25 - 15e$

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

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

$15e^{5k} = 5$

$e^{5k} = 6.3333$

$5k = \ln 6.3333$

$5k = \ln 6.3333$

$5k = -1.0986$

$k = 0.22$

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

ii.) Using Microsoft excel

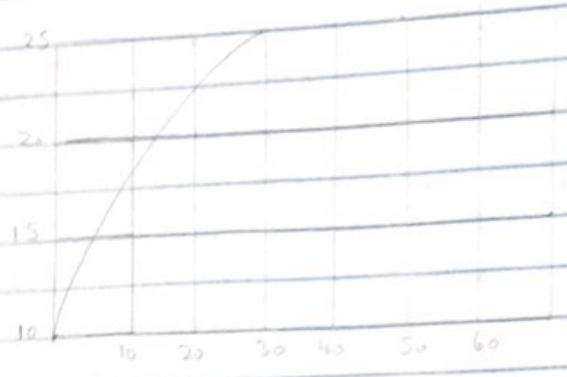
- Pick a box, insert 't'
- Pick another box, insert 'T'
- Under the already labelled box 't'
- Insert the value of 0 in an empty box
- Select Series under the fill tool
- Insert a Step Value of 1
- Change the Series in to Columns
- Insert a Stop Value for 60
- under the already labelled box 'T'
- Insert "$= 25 - (15 * \text{EXP}(-0.22 * A_2))$"
- Auto fill
- Go to Insert
- Pick a graph of your choice
- Label the graph

Out Put:

Using MATLAB

- Commandwindow
- Clear
- clc
- Close all
- t = 0:1:60
- T = 25-15* Exp(-0.022*t)
- Plot (t,T)
- Grid on
- Grid minor

Output:



iv) Using Excell's dynamic response, the steady state 'temp' of system would be 25°c at t.

v) Using the developed model equation the 'temp' of the thermometer at t will be 25°c