Assignment 5

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17/ENG06/018 (Transfer from mechanical to civil)
Civil ENG282 Assignment (5)

a. Mathematical modelling is a process of setting up models, solving it mathematically and interpreting the results in physical and other terms.

b. Models of observing a model
- By use of torricellis law ex leaking tank, outflow of water through a hole
- By newtons law of cooling ex heating an office building

c. $T_{(0)} = 10^{\circ}c$ $T_A = 25^{\circ}c$

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

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

$\int \frac{dT}{T-T_A} = \int K\,dt$

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

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

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

$T = Ae^{kt} + T_A$

when $t = 0$

$10 = A + 25$

$A = 10 - 25 = -15$

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

at $t(5) = 20$

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

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

$15e^{5k} = 5$

$15e^{5A} = 5$

$e^{5A} = 0.333$

$5A = \ln 0.333$

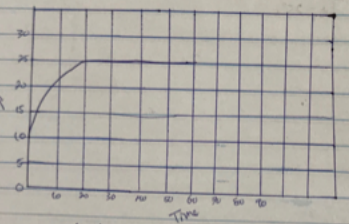
$5A = -1.0986$

$A = -0.22$

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

b using excel

Using the equation $T(t) = 25 - 15e^{-0.22t} \times t$ at time 0:1:60 and graph of temperature (T) against Time (t)



C. Using matlab

Command window

clear

clc

Close all

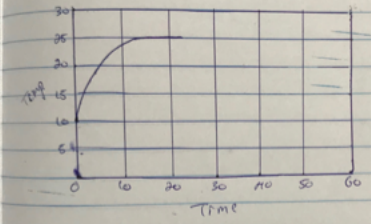
t = 0:1:60

T = 25-15 * ex (-0.22*t)

Plot (t, T)

grid on

grid minor
xlabel('Time (secs)')
ylabel('Temperature (C)')
grid on
grid minor



b The steady state value of the system is at 25°C at 3mins

c Using the modelling equation, the temperature of the thermometer at t=2s. = 25°C