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BIOMEDICAL ENGINEERING 00000 = 00001

17/ENG08/0004 1.0 = 100.0

ENG 252 - (100)01 = 100.0

ENGINEERING MATHEMATICS II

ASSIGNMENT

1. Mathematical modelling is the process of developing a mathematical model. * mathematical model is a description of a system using mathematical concept and language to obtain the value of output. * model may help to explain a system and to study the effect of different components & to make predictions about behaviour.

~~Statistical~~

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Statistical model

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differential equation.

c. T at $0_s = 10^\circ\text{C}$.

T at $5_s = 20^\circ\text{C}$.

Let $T_a = 25^\circ\text{C}$.

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

$$k dt = \frac{dT}{T - T_a}$$

$$\int k dt = \int \frac{1}{T - T_a} dt$$

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

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

$$T - T_a = e^{kt} \cdot e^c$$

Let $T_0 = e^c$

$$T - T_a = T_0 e^{kt}$$

$$T = T_0 e^{kt} + T_a$$

When $t = 0$,

$$10 = T_0 e^{k(0)} + 25 \quad (t=0)$$

$$10 = T_0 + 25$$

$$T_0 = 10 - 25$$

$$T_0 = -15$$

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

at time $t = 5_s$ & $T = 20^\circ\text{C}$.

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

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

$$e^{5k} = \frac{5}{15} = \frac{1}{3}$$

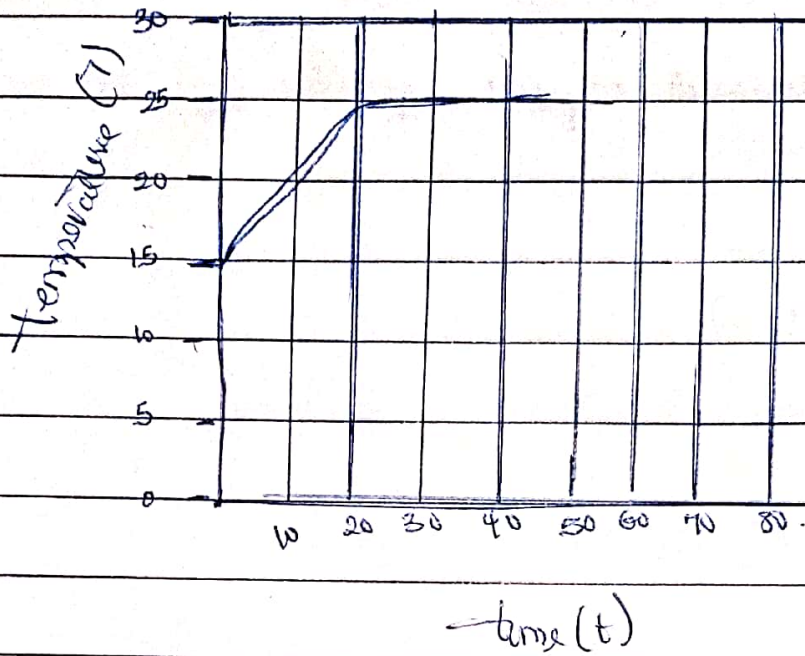
$$e^{5k} = 0.333$$

$$5k = \ln 0.333$$

$$5k = -0.0986 \rightarrow \text{Divide all by 5.}$$

$$k = -0.02$$

$$T(t) = 25 - 15e^{-0.02t}$$



Command window:

clear

clc

close all

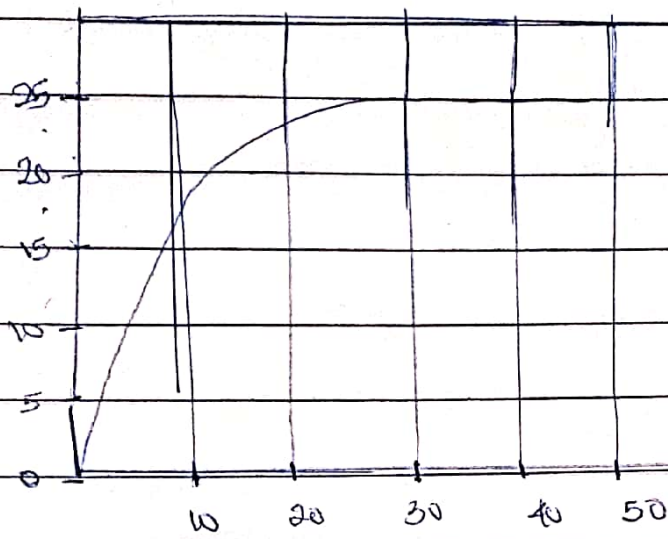
t = 0:1:6;

y = 25 - 5 * exp(-0.52 * t)

plot (t, y)

xlabel 't'

ylabel 'y'



Using Ms Excel's dynamic response, the steady state temperature of the system would be 25°C at 20 seconds.

Using developed equations, the temperature of the thermometer at $t \rightarrow \infty = 25^{\circ}\text{C}$.