SHAPHAN FRANCIS ZURRA Assignment V
COMPUTER ENGINEERING
17/ENG02/028

A. Modelling is the mathematical representation and simulation of a system which involves solving the model and obtaining output variable for different values of input variables.

B. Methods of obtaining models for Engineering system are
i. Differentiating
ii Use of Balance Law

Ci From Newton's Law of cooling

$$\frac{dT}{dt} = K(T - T_A)$$ By seperating the variables

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

$$\int \frac{dT}{(T - T_A)} = \int K dt \equiv \ln(T - T_A) = kt + C$$

$$T - T_A = e^{kt+C} \equiv T - T_A = e^{kt} e^{C}$$

Initially $e^{C} = C$ $\therefore T - T_A = Ce^{kt}$

Where T is the thermometer initial reading 10°C and T_A, the actual temperature of the system 25°C all at time (t) = 0

$$\therefore T - T_A = Ce^{kt}$$
$$10 - 25 = Ce^{k(0)}$$
$$10 - 25 = C$$
$$\therefore C = -15$$

After 5 minutes, the temperature of the thermometer

$T = 20°C$ and $t = 5$

$$\therefore T - T_A = Ce^{kt}$$

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

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

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

$$\frac{-5}{-15} = e^{5k}$$

$$\ln 0.33 = 5k$$

$$k = \frac{-1.0986}{5}$$

$$k = -0.222$$

Therefore the model of the system is

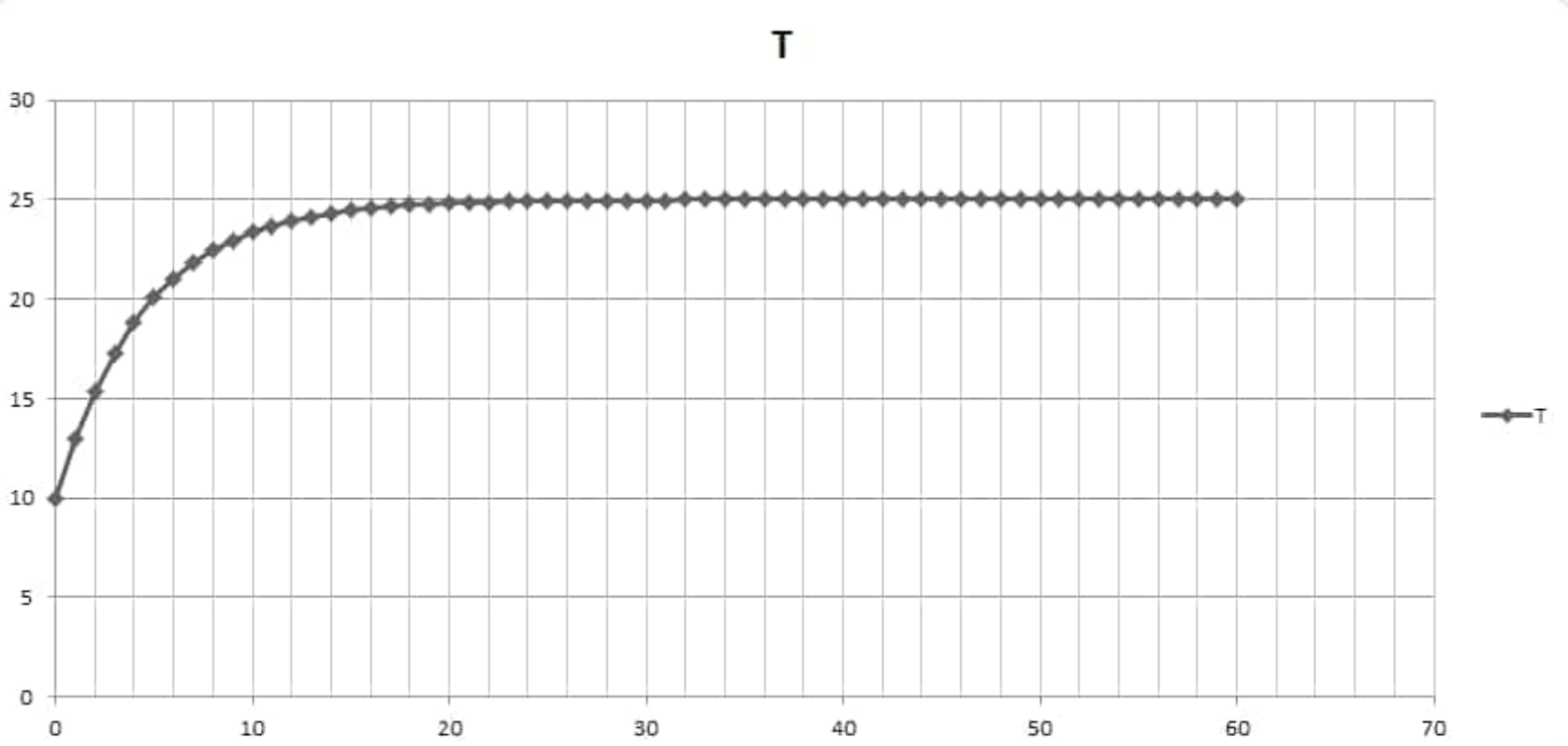
$$T = T_A + Ce^{kt}$$

$$T = 25 - 15e^{-0.222t}$$

ii. Simulation using Microsoft Excel

Some selection from the table t (1-60)

t	T
0	10
6	21.98627
12	23.95497
18	24.72416
24	24.92719
30	24.98078
36	24.99493
42	24.99866
48	24.99965
54	24.99991
60	24.99998



iii. MATLAB Simulation of the Model

Code

```
commandwindow
clear
clc
close all
syms t
t = 0: 1: 60
T = 25-15*(exp(-0.222*t))
T_b = subs T
Plot * (t, T_b)
xlabel ('Time (min)')
ylabel ('Temperature')
axis tight
grid on
grid minor
```