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18/ENG08/1614
BIOMEDICAL ENGINEERING
ENGINEERING MATHEMATICS (ENG 282)

1) The accelerative rate of salt within a system is equal to the input rate of salt into the system minus the output rate of the salt from the system. This is given by the "Balance Law".

∴ Acceleration rate of salt within a system = input rate of salt in the system − output rate of salt from the system

Let the amount of salt present in the tank at any time 't' be 'y'. Time rate of change of $y = \frac{dy}{dt} = y_{in} = y_{out}$

If 50gal of brine enters the tanks 1min and one gallon contains (1+5sin t)lb of salt

∴ the amount of salt entering into the tank is =>

$50 \times 1.02 = 51.65$ lb/min

The tank contains 1250 gal of water dissolved salt and 30 gal of the solution exits the tank per min i.e $\frac{30}{1200} = 0.025 = 2.5\%$

Of the content of the tank. So 2.5% of the salt present inside the tank will also leave the tank per minute i.e $y_{out} = 2.5\%$ of y

a $\frac{dy}{dt}$ lb/min $= 51$ lb/min $- 2.5\%$ of y lb/min

b $\frac{dy}{dt} = 51 - 0.025y$, $\frac{dy}{dt} = -0.025y + 51$

$\frac{dy}{dt} = -0.025\left(\frac{-0.025y}{0.025} + \frac{51}{-0.025}\right)$; $\frac{dy}{dt} = -0.02(y - 204$

$\frac{dy}{(y-2040)} = -0.025dt$, $\int \frac{dy}{(y-2040)} = \int -0.025dt$

$\int \frac{dy}{(y-2040)} = -0.025 \int dt$; $\ln(y-2040) = -0.025t + c$

$y - 2040 = e^{-0.025t+c}$; $y - 2040 = e^{-0.024} e^{c}$

$y - 2040 = e^{-0.025t} y_0$; $y - 2040 = y_0 e^{-0.025t}$

$y = y_0 e^{-0.025t} + 2040$; Initially, when $t = 1$

$y = 1506$

$\therefore 150 = y_0 e^{-0.025t} + 2040$, $150 - 2040 = y_0 \times 1$

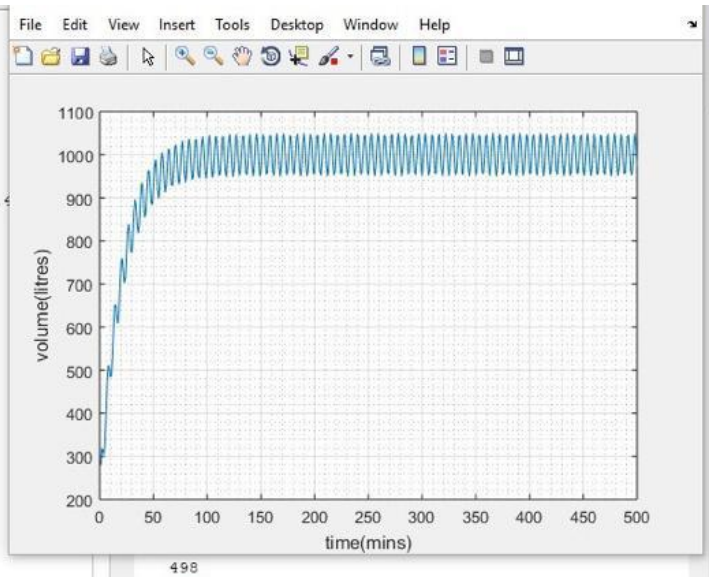
$y_0 = -1890$

So;

$y = -1890 e^{-0.025t} + 2040$

$y = 2040 - 1890 e^{-0.025t}$

```
commandwindow
clear
clc
close all
syms t
values=[]
t=1:1:500
mean=1000-((exp(-0.05*t))*800)
y=1000+(50/1.0025)*sin(t)+(2.5/1.0025)*cos(t)-((exp(-0.05*t))*802.4
if rem(t,2) ==0
    values=[values,mean]
else
    values=[values,y]
end
excelvalues=transpose(values)
mins=transpose(t)
plot(t,values)
grid on
grid minor
xlabel ('time(mins)')
ylabel('volume(litres)')
xlswrite('odevbesdata.xlsx',{'t(min)'},'veriler','A1')
xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
```

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498
499
500
```

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	t(min)	V(Litre)																			
2	1	279.9639																			
3	2	318.1907																			
4	3	313.8601																			
5	4	303.601																			
6	5	327.9009																			
7	6	393.9593																			
8	7	469.1423																			
9	8	511.0566																			
10	9	506.5922																			
11	10	484.0395																			
12	11	487.1398																			
13	12	534.9268																			
14	13	604.2824																			
15	14	651.2431																			
16	15	651.4694																			
17	16	622.6706																			
18	17	608.3676																			
19	18	637.9229																			
20	19	699.585																			
21	20	751.3315																			
22	21	759.541																			
23	22	729.9392																			
24	23	702.3679																			
25	24	714.1865																			
26	25	765.9535																			
27	26	820.9421																			
28	27	838.9333																			
29	28	813.2194																			
30	29	776.7953																			

```
commandwindow
clear
clc
close all
syms t
y = (50/0.05)+((50/1.0025)*sin(t))+(((50*(0.05))/1.0025)*cos(t)
ym = 1000-(800*exp(-0.05*t))
oddValues = 1:2:500
evenValues = 2:2:500
ym = double(subs(y, oddValues))
ymm = double (subs(ym, evenValues))
totTime = 1:1:500
timeTrans = totTime'
c = reshape([ym,ymm],[],1)
combVal = double(c)
plot(totTime, c)
grid on
grid minor
xlabel('T(min)'), ylabel('V(litre)')
col_header = {'t(min)', 'V(Litre)'}
xlswrite['odevbesdata.xlsx',col_header,'veriler','A2')
xlswrite['odevbesdata.xlsx',timeT,'veriler','A3')
xlswrite['odevbesdata.xlsx',combined,'veriler','B2')
```

Workspace

Name	Value
c	62750x1 double
combVal	62750x1 double

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6:52 PM
5/6/2020