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18/ENG02/1058
COMPUTER ENGINEERING

(a) Applying Balance law,
Accumulation rate = Input rate of salt - output rate of salt.

Denoting the amount of salt present in the tank any time t as y, its time rate of change is given as,
$dy/dt = y_{in} - y_{out}$

Since 5gal of brine enter the tank per minute and one gallon contains (1 lb) = (1 lb/gal) = 1.02 lb of salt:
∴ It means that the amount of salt entering the tank is:
$y_{in} = 5 gal/min \times 1.02 lb/gal = 5 lb/min$

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The tank Contains 200 gal of water with the dissolved salt & 30 gallons of the solution leaves the tank per minute. That is $\frac{30 gal}{200 gal} = 0.025$

= 2.5% of the Content of the tank. If that is the case, 25% of the salt present in the tank will also leave the tank per min in other words.

$J_{out} = 2.5\%$ of J

Therefore; $\frac{dJ}{dt}$ lb/min = 5 lb/min - 2.5% of J lb/min

$\frac{dJ}{dt} = 8 - 0.025J$; $\frac{dJ}{dt} = -0.025J + 8$,

$\frac{dJ}{dt} = -0.025\left[\frac{-0.025J}{-0.025} + \frac{8}{-0.025}\right]$; $\frac{dJ}{dt} = -0.025(J - 200)$

$\frac{dJ}{J - 200} = -0.025dt$; $\int \frac{dJ}{J-200} = \int -0.025dt$

$\int \frac{dJ}{(J-200)} = -0.025\int dt$; $\ln(J-200) = -0.025t + C$

$J - 200 = e^{-0.025t + C}$; $J - 200 = e^{-0.025t}e^{C}$

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$J - 240 = e^{-0.2t} J_0$; $J - 2040 = J_0 e^{-0.025}$;

$J = J_0 e^{-0.025t} + 2040$, Given that when $t = 0$ min (initially), $J = 1506$

$150 = J_0 e^{0.025(0)} + 2040$; $150 - 2040 = J \times 1$

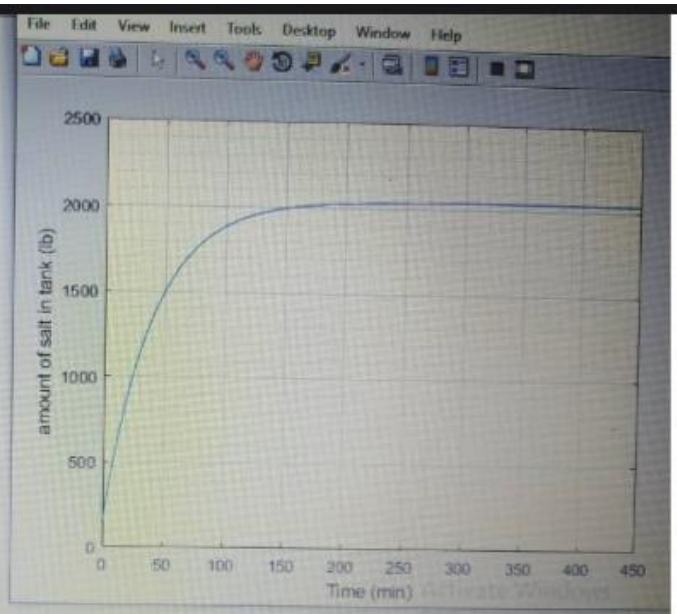
$J_0 = 1890$

Then,

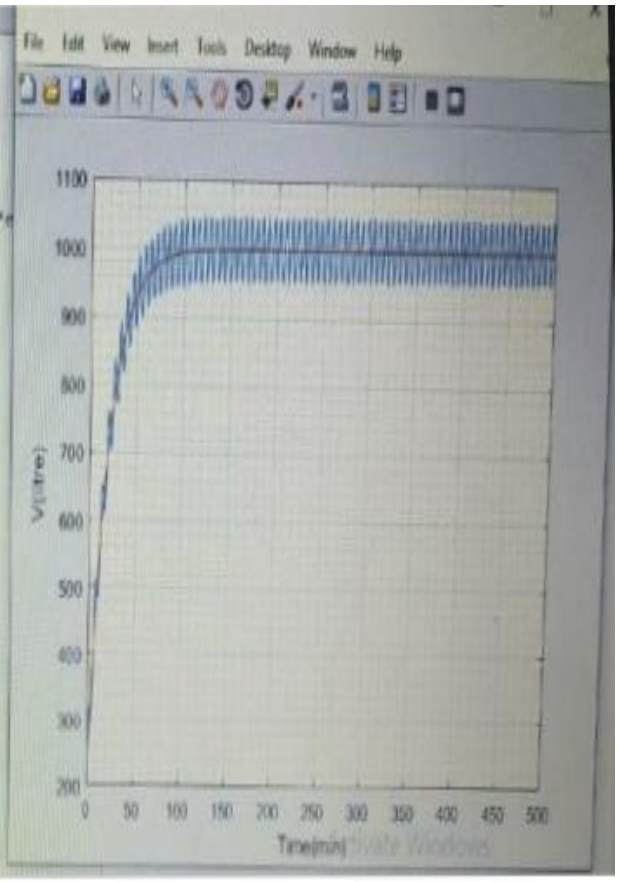
$J = -1890e^{-0.025t}$

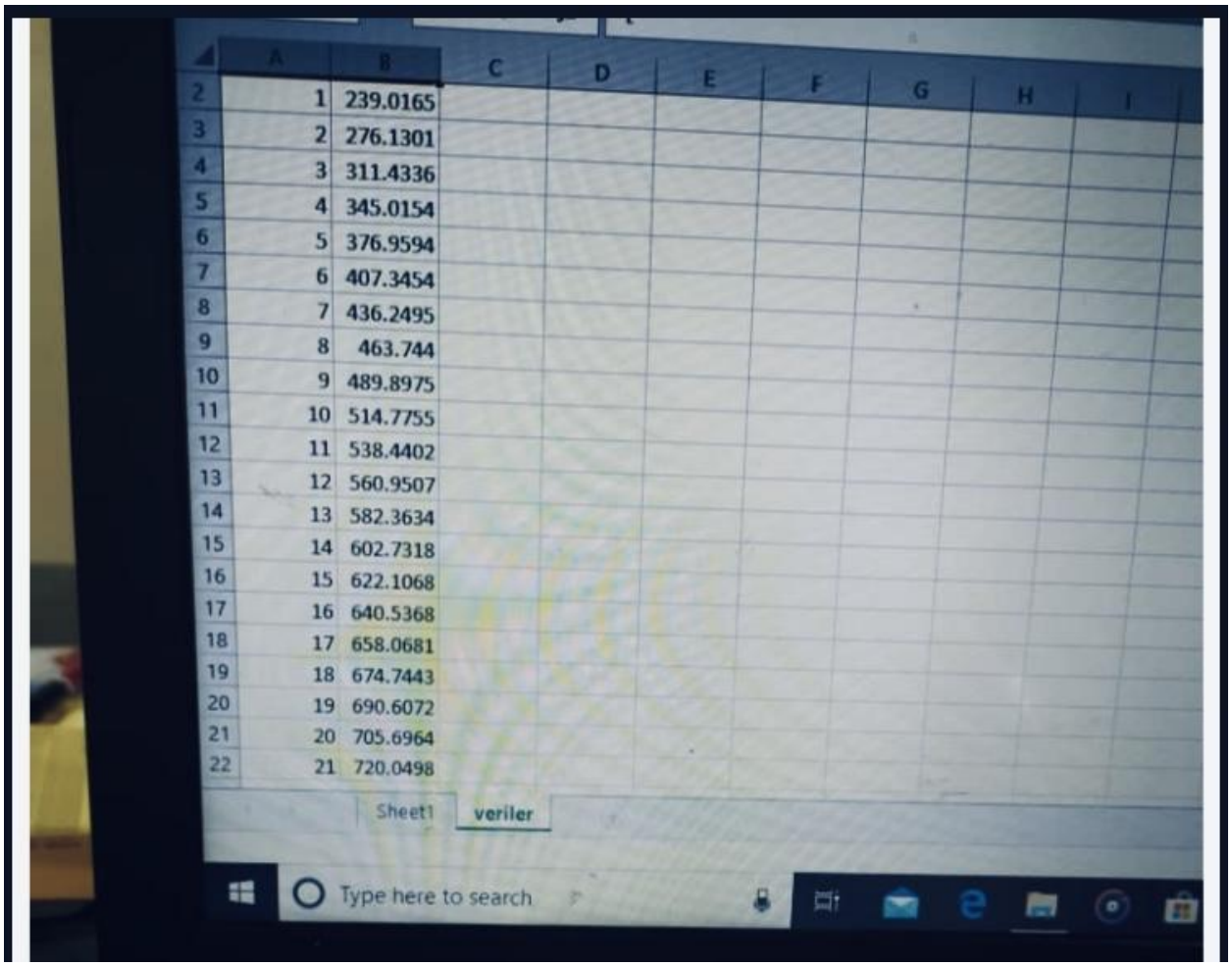
$J = 2040 - 1890e^{-0.025t}$.

```
commandwindow
clearvars
clc
close all
t = 0:0.5:450;
m = 2040 - 1890*exp(-0.025*t);
plot(t,m)
xlabel('Time (min)')
ylabel('amount of salt in tank (lb)')
grid on
grid minor
```



```
commandwindow
clearvars
clc
close all
t = 0:1:500;
y= (50/0.05)+(50*sin(t)/1.0025)+(50*0.05*cos(t)/1.0025)-802.49*e
plot(t,y)
hold on
tm = 1:1:500;
ym= 1000 - 800*exp(-0.05*tm);
plot(tm,ym)
hold off
xlabel('Time(min)')
ylabel('V(litre)')
grid on
grid minor
xlswrite('odevdeadata.xlsx',[t(:),y(:)],'veriler','A2')
xlswrite('odevdeadata.xlsx',[tm(:),ym(:)],'veriler','A2')
```





	A	B	C	D	E	F	G	H	I
2	1	239.0165							
3	2	276.1301							
4	3	311.4336							
5	4	345.0154							
6	5	376.9594							
7	6	407.3454							
8	7	436.2495							
9	8	463.744							
10	9	489.8975							
11	10	514.7755							
12	11	538.4402							
13	12	560.9507							
14	13	582.3634							
15	14	602.7318							
16	15	622.1068							
17	16	640.5368							
18	17	658.0681							
19	18	674.7443							
20	19	690.6072							
21	20	705.6964							
22	21	720.0498							

Sheet1 veriler

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