

NAME: ODILI BLOSSOM ONI/MECH
 MAT NO: 18/ENG01/014
 DEPT: CHEMICAL ENGINEERING

ENGINEERING MATH ASSIGNMENT

Q1) Using Balance law

$$\left\{ \begin{array}{l} \text{Accumulation} \\ \text{rate of salt} \\ \text{within a system} \end{array} \right\} = \left\{ \begin{array}{l} \text{Input rate of} \\ \text{salt into} \\ \text{system} \end{array} \right\} - \left\{ \begin{array}{l} \text{Output rate of} \\ \text{salt from the} \\ \text{system} \end{array} \right\}$$

$$\frac{dy}{dt} = y_{in} - y_{out}$$

Since 50 gals enter per minute and one galons contain (1 + sint)
 Therefore, $y_{in} = 50(1 + \sin t)$

The tank contains 1200 gals of water with dissolved salt, and 30 gallons of solution leave the tank per minute

That is $\frac{30}{1200} = 0.025$ = that is 2.5% of salt present

leaves the tank $\therefore y_{out} = 2.5\% \text{ of } y = 0.025y$

Therefore

$$\frac{dy}{dt} \frac{\text{lb}}{\text{min}} = 50(1 + \sin t) \frac{\text{lb}}{\text{min}} - 0.025y \frac{\text{lb}}{\text{min}}$$

$$\frac{dy}{dt} = 50(1 + \sin t) - 0.025y \quad \text{--- (i)}$$

$$\frac{dy}{dt} + 0.025y = 50(1 + \sin t) \quad \text{--- (ii)}$$

$$\frac{dy}{dt} + 0.025y = 50 + 50 \sin t \quad \text{--- (iii)}$$

Compare equation (iii) with $\frac{dy}{dx} + Py = Q$

$$\frac{dy}{dx} = \frac{dy}{dt} \quad P = 0.025 \quad Q = 50 + 50 \sin t$$

$$\int P dt = 0.025t \quad I.F. = e^{\int P dt}$$

$$I.F. = e^{0.025t}$$

$$y \cdot I.F. = \int Q I.F. dt$$

$$y \cdot e^{0.025t} = \int (50 + 50 \sin t) \cdot e^{0.025t} dt \quad \dots (iv)$$

$$ye^{0.025t} = \int 50e^{0.025t} + 50e^{0.025t} \sin t dt$$

$$ye^{0.025t} = 50 \int e^{0.025t} + e^{0.025t} \sin t dt \quad \dots (v)$$

$$ye^{0.025t} = 50 \left[\int e^{0.025t} + \int e^{0.025t} \sin t dt \right] \quad \dots (vi)$$

$$ye^{0.025t} = 50 \left[\frac{e^{0.025t}}{0.025} + \int e^{0.025t} \sin t dt \right] \quad \dots (vii)$$

$$ye \int e^{0.025t} \sin t dt = \int u dv = uv - \int v du \quad \dots (viii)$$

$$u = e^{0.025t} \quad du = 0.025 e^{0.025t}$$

$$dv = \sin t \quad v = -\cos t$$

$$\int e^{0.025t} \sin t = e^{0.025t} \cdot -\cos t - \int -\cos t \cdot 0.025 e^{0.025t} dt \quad \dots (ix)$$

$$\int e^{0.025t} \sin t = -e^{0.025t} \cos t + 0.025 \int e^{0.025t} \cos t dt \quad \text{--- (i)}$$

$$u = e^{0.025t} \quad du = 0.025 e^{0.025t} dt \quad dv = \cos t \quad v = \sin t$$

$$= -e^{0.025t} \cos t + 0.025 \left[e^{0.025t} \sin t - \int \sin t \cdot 0.025 e^{0.025t} dt \right] \quad \text{--- (ii)}$$

$$= -e^{0.025t} \cos t + 0.025 \left[e^{0.025t} \sin t - 0.025 \int \sin t e^{0.025t} dt \right] \quad \text{--- (iii)}$$

$$\text{let } I = \int e^{0.025t} \sin t dt$$

$$I = -e^{0.025t} \cos t + 0.025 \left[e^{0.025t} \sin t - 0.025 I \right] \quad \text{--- (iv)}$$

$$I = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t - 0.00625 I \quad \text{--- (v)}$$

$$I + 0.00625 I = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t \quad \text{--- (vi)}$$

$$1.00625 I = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t + C \quad \text{--- (vii)}$$

$$I = \frac{e^{0.025t} (0.025 \sin t - \cos t) + C}{1.00625} \quad \text{--- (viii)}$$

recall that $I = \int e^{0.025t} \sin t dt$ \therefore sub equation (viii) in (i)

$$y e^{0.025t} = 50 \left[\frac{e^{0.025t}}{0.025} + \frac{e^{0.025t} (0.025 \sin t - \cos t) + C}{1.00625} \right]$$

$$y e^{0.025t} = \frac{50 e^{0.025t}}{0.025} + \frac{50 e^{0.025t} (0.025 \sin t - \cos t) + 50 C}{1.00625}$$

divide through by $e^{0.025t}$ ($C = y_0$)

$$y = \frac{50}{0.025} + \frac{50}{1.00625} (0.025 \sin t - \cos t) + \frac{50 y_0}{e^{0.025t}} \quad \text{--- (ix)}$$

Given that when $t=0$ $y=150$

$$150 = 2000 + 49.969(0-1) + 50y$$

$$y = \frac{-2000 + 49.969 + 150}{50}$$

$$y_0 = -36.0006$$

Substitute in equation (xxx)

$$y = \frac{50}{0.025} + \frac{50}{100025} (0.025 \sin t - \cos t) + \frac{50 \times -36.0006}{e^{0.025t}}$$

$$y = 2000 + 49.969(0.025 \sin t - \cos t) - \frac{1800.031}{e^{0.025t}}$$

final Ans

$$y = 2000 + 49.969(0.025 \sin t - \cos t) - \frac{1800.031}{e^{0.025t}}$$

If Amount of Salt at time t is m !

$$m = 2000 + 49.969(0.025 \sin t - \cos t) - \frac{1800.031}{e^{0.025t}}$$

```
*14 assignmentpractice5.m x vectorpractice1.m x onlinequiz14.m x blossomassignment.m x testinggraph1.m x assignmentpractice311.m x +
1 - commandwindow
2 - clear all
3 - clc
4 - syms y(t)
5 - Q=diff(y)==50*(1+sin(t))-(0.025*y)
6 - Cond=y(0)==150
7 - Ysol(t)=solve(Q,Cond)
8 - t=0:0.5:450
9 - plot(t,Ysol(t))
10 - grid on
11 - grid minor|
```

Command Window

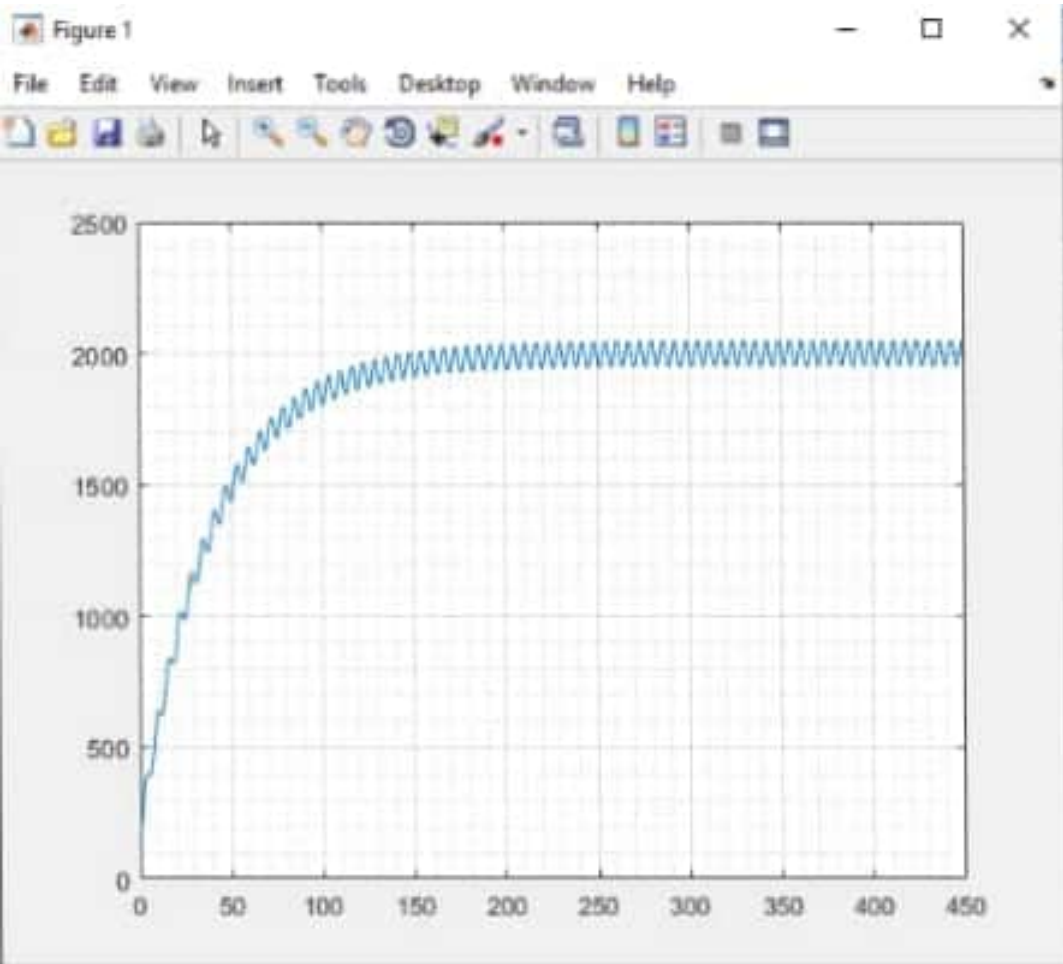
New to MATLAB? See resources for [Getting Started](#).

444.0000	444.5000	445.0000	445.5000	446.0000	446.5000	447.0000	447.5000	448.0000	448.5000	449.0000	449.5000
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

Column 901

450.0000

fx >>



Search Documentation

testinggraph1.m x assignmentpractice5IL.m

Command Window

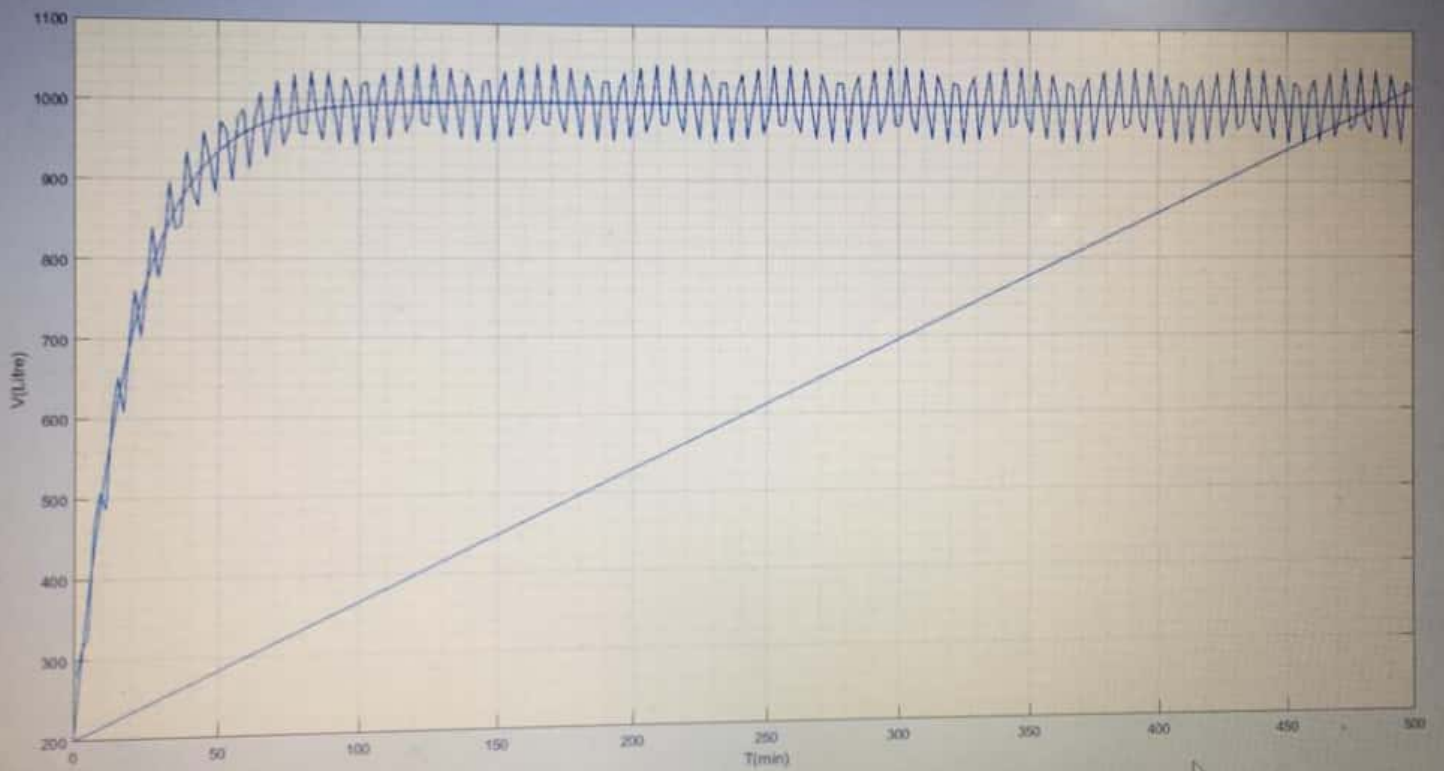
MATLAB? See resources for [Getting Started](#).

4.0000 444.5000 445.0000 445.5000 446.0000 446.5000 447.0000 447.5000 448.0000 448.5000 449.0000

Column 901

0.0000

```
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - t=1:2:500;
6 - tm=0:2:500;
7 - T=[t,tm];
8 - yn=((50/0.05)+ ((50/1.0025)*sin(t)) + (((50*0.05)/1.0025)*cos(t)) - (802.49*exp(-0.05*t)));
9 - ym=((1000)-(800*exp(-0.05*tm)));
10 - V=[yn,ym];
11 - plot(T,V)
12 - grid on
13 - grid minor
14 - xlabel('T(min)')
15 - ylabel('V(Litre)')
16 - col_header=['T(min)', 'V(liter)'];
17 - xlswrite('odevbsdata.xls',[T(:),V(:)], 'veriler', 'A2')
18 - xlswrite('odevbsdata.xls', col_header, 'veriler', 'A2')
19
20
```



odevhesulata - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

Clipboard Font Alignment Number Styles Cells Editing

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	T(min)	V(liters)																				
2	1	279.9639																				
3	3	313.8601																				
4	5	327.9009																				
5	7	469.1423																				
6	9	506.5922																				
7	11	487.1398																				
8	13	604.2824																				
9	15	651.4694																				
10	17	608.3676																				
11	19	699.585																				
12	21	759.541																				
13	23	702.3679																				
14	25	765.9535																				
15	27	838.9333																				
16	29	776.7953																				
17	31	811.8028																				
18	33	895.7197																				
19	35	836.9388																				
20	37	843.6308																				
21	39	934.561																				
22	41	886.318																				
23	43	866.4219																				
24	45	959.1673																				
25	47	927.1558																				
26	49	883.9312																				
27	51	972.6189																				
28	53	960.76																				
29	55	898.8906																				
30	57	977.5784																				

Sheet1 veriler