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**DEPARTMENT: MECHATRONICS ENGINEERING**

**MATRIC NO: 18/ENG05/002**

**ENGINEERING MATHEMATICS ASSIGNMENT V**

**COURSE CODE : ENG282**

18/ENG05/002  
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Mechatronics Engineering

MATRIC NO: 18/ENG05/002

Engineering Mathematics Assignment

Question 1 solution

$$(a) \frac{dm}{dt} = M_{in} - M_{out}$$

$$M_{in} = 50 \text{ gal} \times (1 + \sin t) \text{ lb}$$

$$M_{out} = \frac{30 \text{ gal/minute}}{1200 \text{ gal}} = 0.025 \text{ m}$$

$$\frac{dm}{dt} = 50(1 + \sin t) - 0.025 \text{ m}$$

$$(b) \frac{dm}{dt} = 50(1 + \sin t) - 0.025 \text{ m}$$

Using integrating the factor method.

$$\frac{dm}{dt} + 0.025 \text{ m} = 50(1 + \sin t)$$

$$P = 0.025, \quad Q = 50(1 + \sin t)$$

$$y \cdot IF = \int Q \cdot IF$$

$$IF = e^{\int P dt}$$

$$\int P dt = \int 0.025 dt$$

$$= 0.025 t$$

$$\text{let } y = m, \quad m \cdot IF = \int Q \cdot IF dt$$

$$m \cdot e^{0.025t} \cdot \int 50(1 + \sin t) \cdot e^{0.025t} dt$$

$$\int 50(1 + \sin t) \cdot e^{0.025t} dt = \int 50e^{t/40} (1 + \sin t) dt$$

$$= 50 \int e^{t/40} (1 + \sin t) dt \quad \text{let } 50 = \cancel{50}$$

$$\text{let } u = \frac{t}{40}, \text{ then } \frac{du}{dt} = \frac{1}{40}, dt = 40 du$$

$$40 \int e^u (1 + \sin 40u) du$$

$$\text{let } p = 1 + \sin 40u$$

$$dp = e^u du$$

$$\frac{dp}{du} = 40 \cos 40u$$

$$\int du = \int e^u du$$

$$v = e^u$$

$$dp = 40(\cos 40u) du$$

$$\int dp du = pv - \int v dp$$

~~...~~

$$= \int e^u (1 + \sin 40u) du = e^u (1 + \sin 40u) - \int 40e^u (\cos 40u) du$$

$$\int 40e^u (\cos 40u) du = 40 \int e^u (\cos 40u) du$$

$$\text{let } q = \cos 40u$$

$$\int e^u \cos 40u du \quad \text{let } m = \cos 40u$$

$$\frac{dm}{du} = -40 \sin 40u$$

$$dv = e^u du$$

$$\int dv = \int e^u du$$

$$v = e^u$$

$$\int m dv = mv - \int v dm$$

$$\int e^u \cos 4u du = e^u \cos 4u - \int -4e^u (\sin 4u) du$$

$$\text{let } v = -4 \sin 4u \quad dv = e^u$$

$$\frac{dv}{du} = -16 \cos 4u \quad \int dv = \int e^u du$$

$$v = e^u$$

$$\int e^u \cos 4u du = e^u \cos 4u - (-4e^u \sin 4u) - \int -16e^u \cos 4u du$$

$$\int e^u \cos 4u du = e^u \cos 4u + 4e^u \sin 4u + 16 \int e^u \cos 4u du$$

$$\int e^u \cos 4u du + 16 \int e^u \cos 4u du = e^u \cos 4u + 4e^u \sin 4u$$

$$16 \int e^u \cos 4u du + \int e^u \cos 4u du = e^u \cos 4u + 4e^u \sin 4u$$

$$-1599 \int e^u \cos 4u du = -1599 \int e^u \cos 4u du$$

$$\int e^u \cos 4u du = \frac{e^u \cos 4u + 4e^u \sin 4u}{-1599 \cdot 1601}$$

Putting R on LHS and RHS

ie multiplies by R

$$40 \int e^u \cos 4u du = 40 (e^u \cos 4u + 4e^u \sin 4u)$$

but  $\int e^{ct} (1 + \sin 4t) dt = e^{ct} (t \sin 4t + 1) -$

but  $\int e^{ct} (1 + \sin 4t) dt = e^{ct} (t \sin 4t) - \int 40 e^{ct} \cos 4t du$

$\int e^{ct} (\sin 4t + 1) dt = e^{ct} \sin 4t + 1 =$   
 $40 (40 e^{ct} \sin 4t + e^{ct} \cos 4t)$   
~~1599~~ 1601

$40 \int e^{ct} \sin 4t + 1 dt = 40 e^{ct} (\sin 4t + 1) -$   
 $1600 (40 e^{ct} \sin 4t + e^{ct} \cos 4t)$   
~~1599~~ 1601

Put in  $C = 50$ , multiplying by 50  
 $50 \int e^{5t/40} (1 + \sin t) dt$

$2000 e^{5t/40} (1 + \sin t) - 80000 (40 e^{5t/40} \sin t + e^{5t/40} \cos t)$   
~~1599~~ 1601

so  $\int e^{5t/40} (1 + \sin t) dt = 2000 e^{5t/40} (\sin t - 40 \cos t + 1) + C$

M.I.F =  $\int Q \cdot I.F$

$me^{0.025t} = \int 50 (1 + \sin t) \cdot e^{0.025t} dt$

substituting

$$m = 200 \frac{(\sin t - 40 \cos t + 160t)}{e^{0.025t}} - C$$

putting  $t = 0, m = 150$

$$150 = 2000 \frac{(\sin 0 - 40 \cos 0 + 160 \cdot 0)}{e^{0.025 \cdot 0}} + C$$

$$150 = 1950 - 0 + C$$

$$C = 150 - 1950 = -1800$$

$$m = 2000 \frac{(\sin t - 40 \cos t + 160t)}{e^{0.025t}} - 1800$$

$$m \cdot e^{-0.025t} \cdot \int_{50}^{\infty} (1 + \sin t) \cdot e^{-0.025t} dt$$

$$\int_{50}^{\infty} (1 + \sin t) \cdot e^{-0.025t} dt = \int_{50}^{\infty} 50e^{-t/40} (1 + \sin t) dt$$

$$= 50 \int_{50}^{\infty} e^{-t/40} (1 + \sin t) dt \quad \text{let } u = t/40$$

$$\text{let } u = \frac{t}{40} \quad \text{then } \frac{dt}{dt} = \frac{1}{40} \quad dt = 40 du$$

$$40 \int_{50}^{\infty} e^{-u} (1 + \sin 40u) du$$

$$\text{let } p = 1 + \sin 40u \quad \frac{dp}{du} = 40 \cos 40u \quad \frac{dr}{du} = e^{-u}$$

$$dp = 40 \cos 40u du \quad v = e^{-u}$$

$$\int dp \cdot v = p \cdot v - \int v \cdot dp$$

~~40e^{-u} (1 + \sin 40u) - \int 40e^{-u} \cos 40u du~~

$$= \int e^{-u} (1 + \sin 40u) du = e^{-u} (1 + \sin 40u) - \int 40e^{-u} \cos 40u du$$

$$\int 40e^{-u} \cos 40u du = 40 \int e^{-u} \cos 40u du$$

$$\text{let } q_0 = p \dots$$

$$\int e^{-u} \cos 40u du \quad \text{let } m = \cos 40u$$

$$\frac{dm}{du} = -40 \sin 40u$$

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- results.xlsx
- odevbesdata.xlsx
- odevbesdata.xls
- odevbesdata.xls
- NTUSER.DAT[80a94c12-ba59-11e9-98d1-ced1ee93...
- NTUSER.DAT[80a94c12-ba59-11e9-98d1-ced1ee93...
- mylabme.mat
- mylabbb.mat
- matlabwork 5b.mat
- matlab.mat
- matlab doc 1.mat
- Untitled42334.m
- Untitled3233.m
- Untitled3.m
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- MYMATHLABBASSIGNMENT.m
- mylabmy.m
- mylab.m
- mela.m

Details

Select a file to view details

Editor - C:\Users\Zinox\abimbolaoluwafemiiiiibf.m

```

1 - commandwindow
2 - clear
3 - c1c
4 - close all
5 - t=0:0.5:0.7;
6 - df=dsolve('Dy=50*(1+sin(t))-0.025*y','t')
7 - m=0.0769*exp(-t/40) - (2000*1601*(1/2)*cos(t + atan(1/40)))/1601 + 2000
8 - plot(t,m)
9 - xlabel(' time(hr)')
10 - ylabel('amount of substance')

```

Workspace

Name	Value
t	[0.0 5000]
m	[1.9501e+03 1.95...
df	1x7 sym

Command Window

```

C1*exp(-t/40) - (2000*1601*(1/2)*cos(t + atan(1/40)))/1601 + 2000

```

m =

```

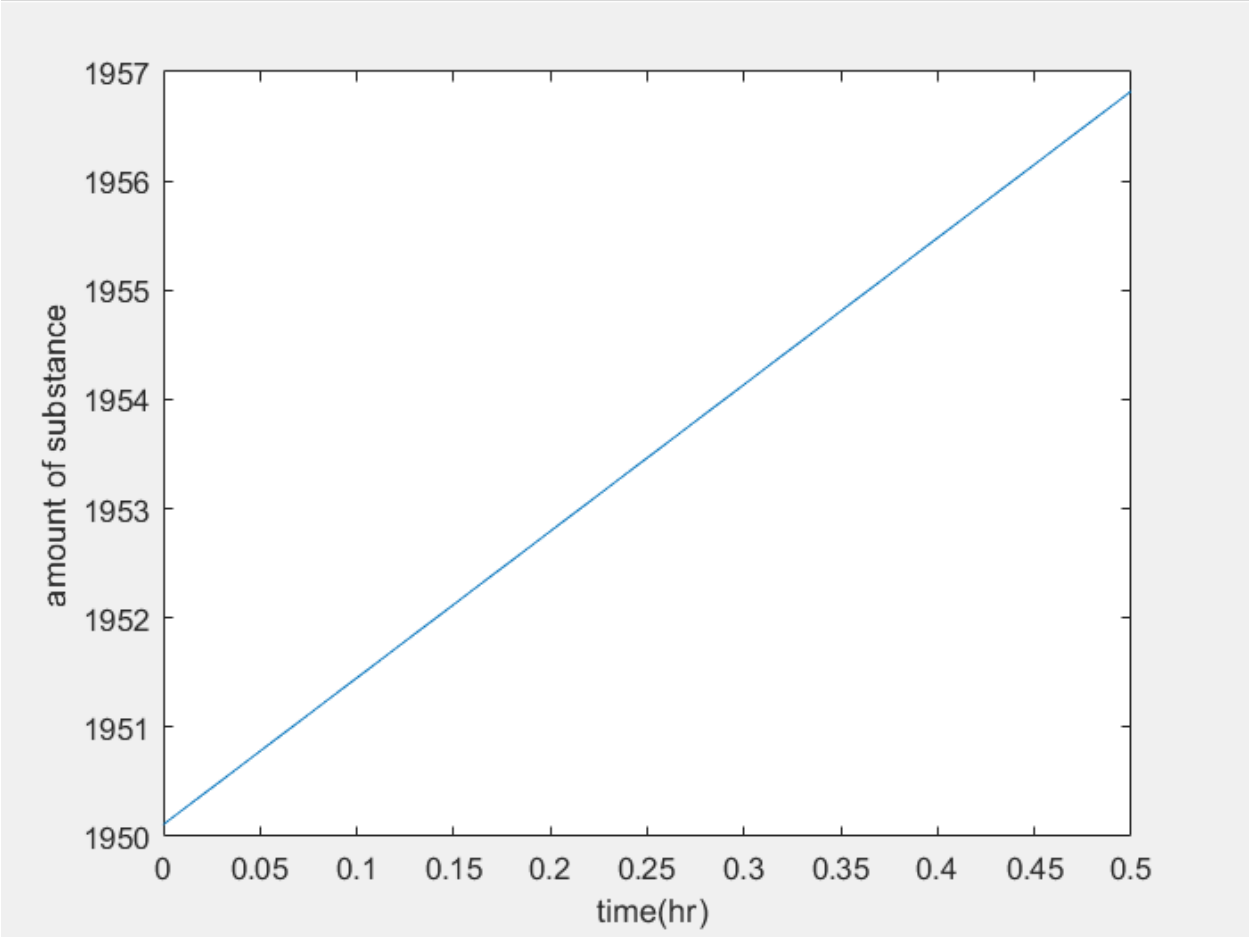
1.0e+03 *
1.9501 1.9568

```

script Ln 9 Col 20



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**GRAPH PLOTTED FROM MANUAL SOLUTION TO EQUATION**

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Insert Comment Breakpoints Run Run and Advance Run and Time

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```

1 - clear
2 - clc
3 - close all
4 - t=0:0.5:0.7;
5 - m=(2000*sin(t)-40*cos(t)+1601)\1601 -1800.03*exp(0.0258*t)
6 - plot(t,m)
7 - xlabel(' time(hr)')
8 - ylabel('amount of substance')
9 -

```

Command Window

```

m =
    -0.0006    -0.0006
     0.6336     0.6336
fx >>

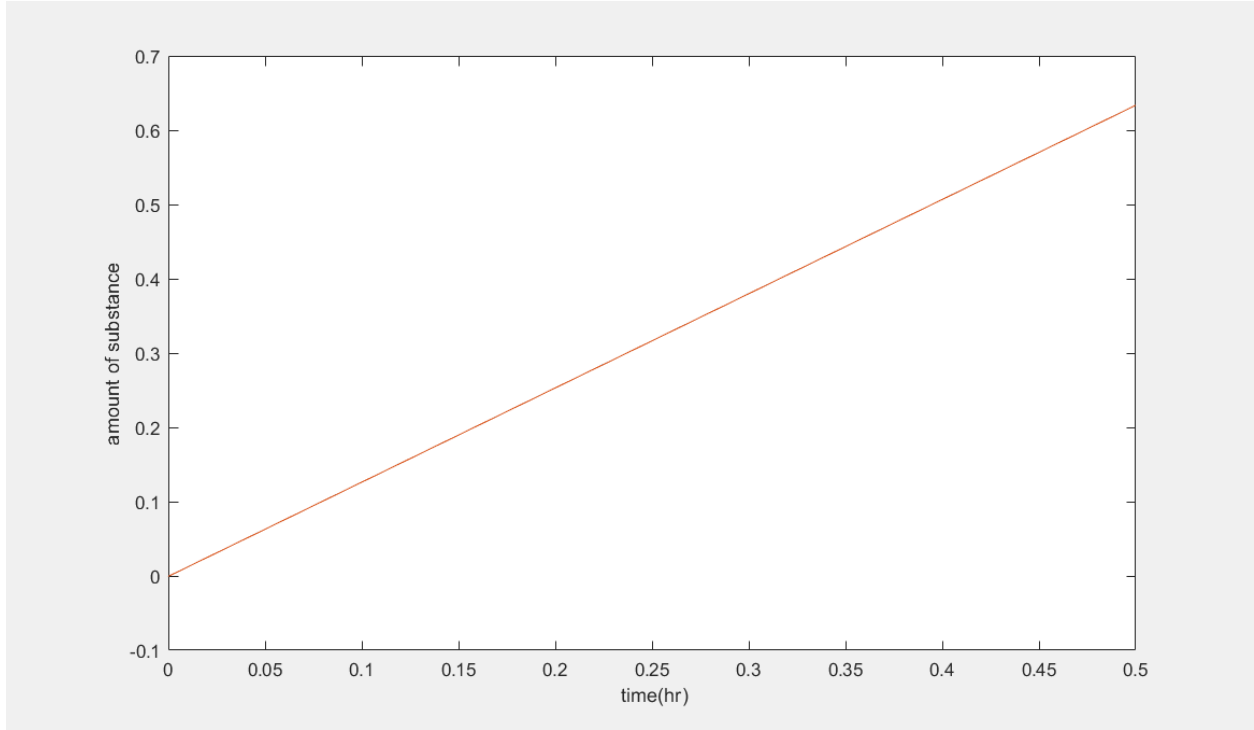
```

Workspace

Name	Value
m	[-5.5555e-04; 5.6...]
t	[0;0.5000]

script Ln 9 Col 6

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## QUESTION 2

The screenshot displays the MATLAB software interface. The main window is the Editor, showing a script named 'AbimbolaOluwafemiGideon.m'. The script contains the following code:

```
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - b=0:1:500;
6 - tp = rem(b,2) ==0
7 - t = 0:tp:500
8 - v = (1000)+(49.88)*(sin(t))+(2.49)*(cos(t)) - (802.49)*exp(-0.05*t);
9 - plot(t,v)
10 - grid on
11 - grid minor
12 - xlsxwrite('odevbesdata',v,'veriler','A2:B2')
```

The Command Window shows the output of the script, displaying the columns of the data matrix:

```
Columns 477 through 493
476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492

Columns 494 through 501
493 494 495 496 497 498 499 500
```

The Workspace window shows the variables defined in the script:

Name	Value
b	1x501 double
t	1x501 double
tp	1x501 logical
v	1x501 double

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