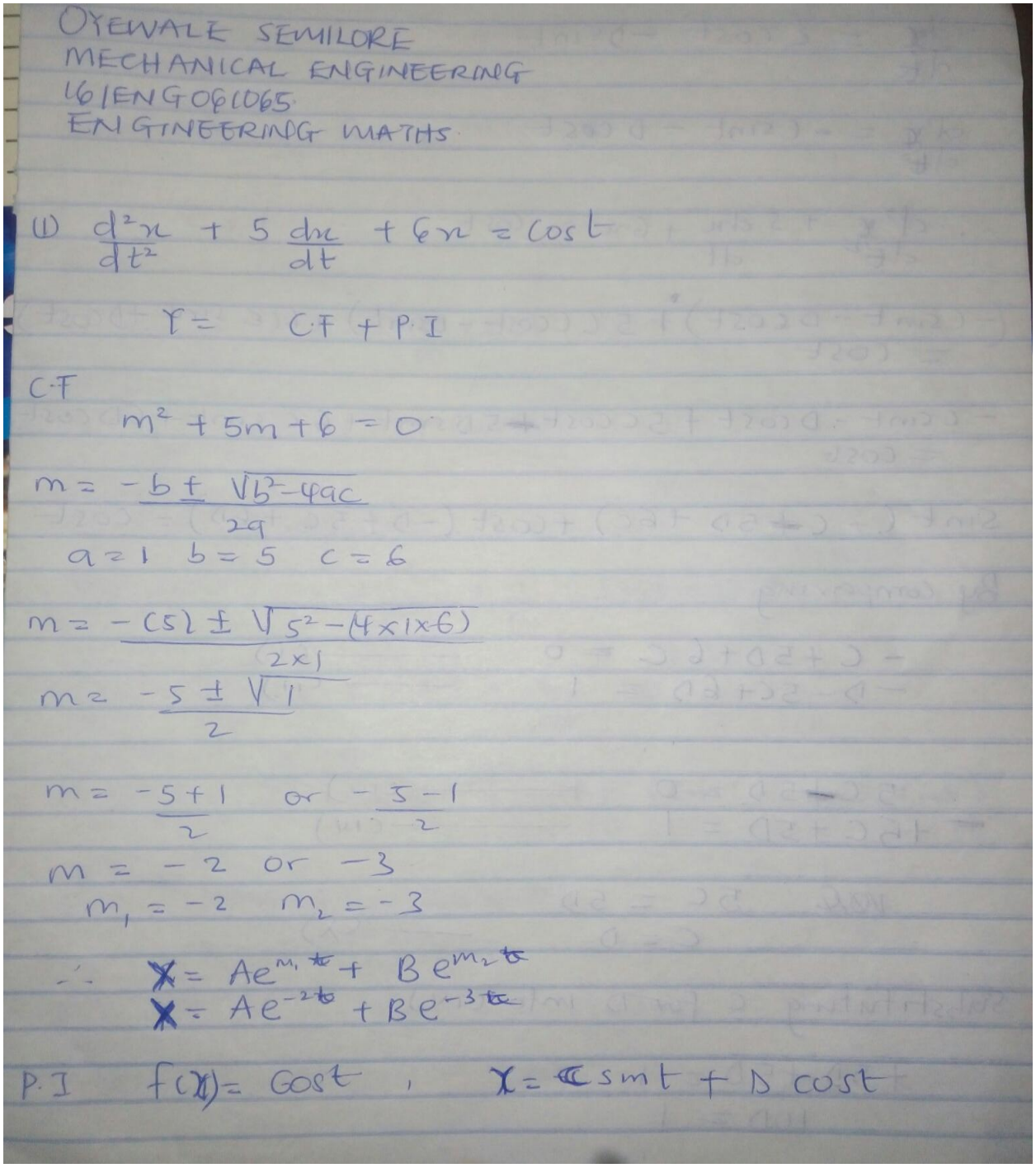
OYEWALE SEMILORE Engineering Mathematics (Eng 381)

300 level.

MECHANICAL ENGINEERING

16/ENG06/065



$\frac{dx}{dt} = C\cos t - D\sin t$

$\frac{d^2x}{dt^2} = -C\sin t - D\cos t$

$\therefore \frac{d^2x}{dt^2} + 5\frac{dx}{dt} + 6x = \cos t$

$(-C\sin t - D\cos t) + 5(C\cos t - D\sin t) + 6(C\sin t + D\cos t) = \cos t$

$-C\sin t - D\cos t + 5C\cos t - 5D\sin t + 6C\sin t + 6D\cos t = \cos t$

$\sin t(-C - 5D + 6C) + \cos t(-D + 5C + 6D) = \cos t$

By comparing

$-C + 5D + 6C = 0$ ——— (i)

$-D - 5C + 6D = 1$ ——— (ii)

$5C - 5D = 0$ ——— (iii)

$+5C + 5D = 1$ ——— (iv)

(or) $5C = 5D$

$C = D$ ——— (x)

Substituting C for D into (iv)

$+5D + 5D = 1$

$10D = 1$

$D = \frac{1}{10}$

Substitute $\frac{1}{10}$ for D into *

$\therefore C = \frac{1}{10}$

$\therefore x = \frac{1}{10}\sin t + \frac{1}{10}\cos t$

$x = \frac{1}{10}(\sin t + \cos t)$

∴ General equation

$x = Ae^{-2t} + Be^{-3t} + \frac{1}{10}(\sin t + \cos t)$

Given $t = 0$, $x = 0.1$ and $\frac{dx}{dt} = 0$

$t = 0$ and $x = 0.1$

$0.1 = Ae^{-2(0)} + Be^{-3(0)} + \frac{1}{10}(\sin(0) + \cos(0))$

$0.1 = A + B + \frac{1}{10}(0 + 1)$

$0.1 = A + B + \frac{1}{10}$

$A + B = 0$ ——— (**)

$$\frac{dx}{dt} = -2Ae^{-2t} + (-3Be^{-3t}) + \frac{1}{10}(-\sin t + \cos t)$$

since $\frac{dx}{dt} = 0$ and $t = 0$

$$0 = -2Ae^{-2(0)} + (-3Be^{-3(0)}) + 0.1(-0+1)$$

$$-0.1 = -2A - 3B \quad \text{——— (***)}$$

$$-0.1 = -2A - 3B \times 1$$
$$0 = A + B \times 2$$

~~$0 = -2A - 3B$~~
+ ~~$0 = 2A + 2B$~~

~~$-B = 0$~~
~~$B = 0$~~

Substitute 0 for B into (*)
~~$0 = A + B$~~
~~$A = 0$~~

$A = -B$

substituting for A into ** eqn

$$3(-B) + 2B = 0.1$$
$$-B = 0.1$$
$$B = -0.1$$
$$A = -B$$
$$A = 0.1$$

$$\therefore x = 0.1e^{-3t} - 0.1e^{-2t} + 0.1(\cos t + \sin t)$$

$$x = 0.1(e^{-3t} - e^{-2t} + \cos t + \sin t)$$

$$x = \frac{1}{10}(e^{-3t} - e^{-2t} + \cos t + \sin t)$$

18. Write a steady - state solution of the system in form of $x = k\sin(t+q)$

Answer

From the equation

$$x = Ae^{-2x} + Be^{-3x} + \frac{1}{10}(\sin t + \cos t)$$

The equation has a changing or transient part and a steady part

The transient part denoted as $e^{k_1 t}$ and $e^{k_2 t}$

The steady part denoted $\frac{1}{10}(\sin t + \cos t)$

In trigonometric identities

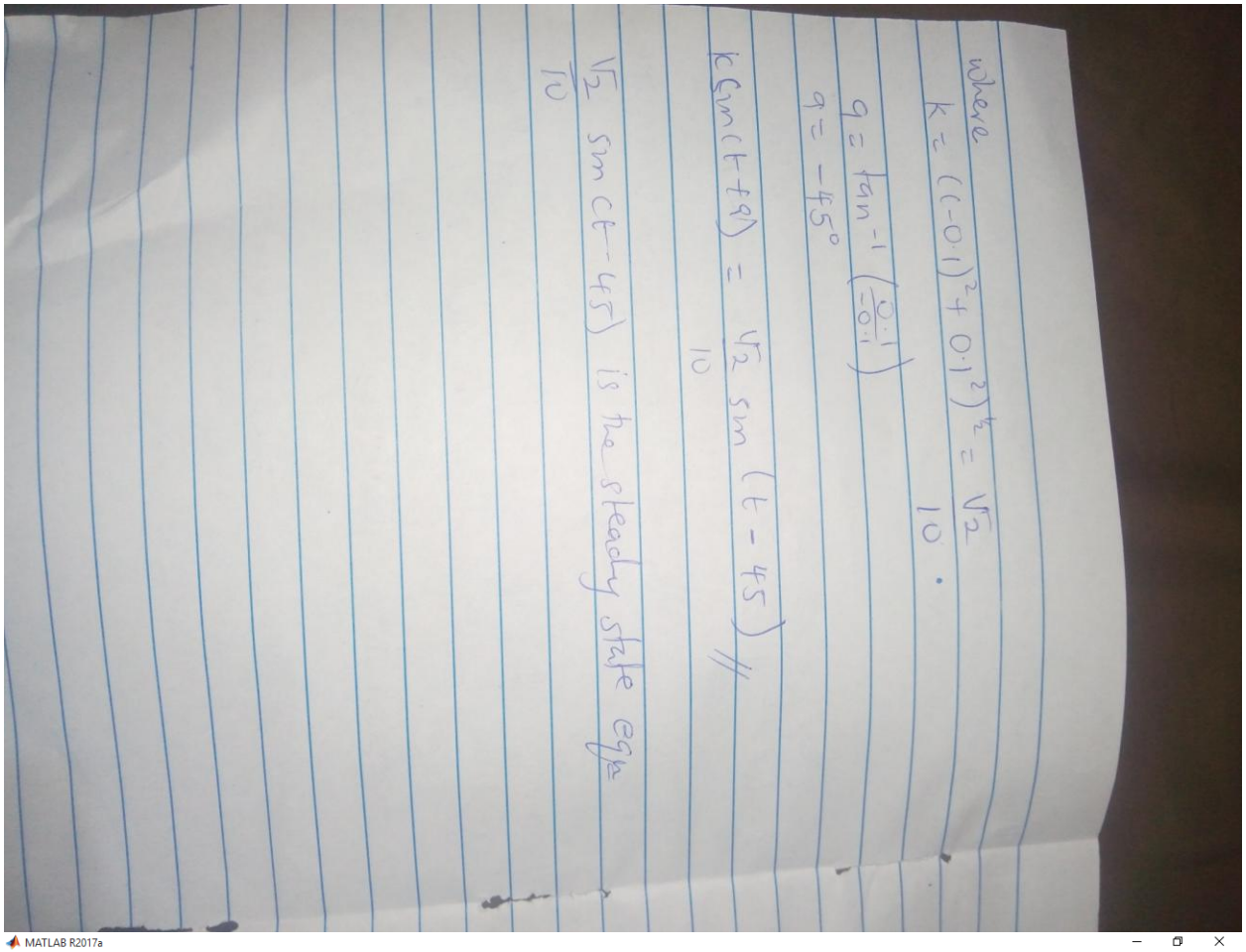
$$A\sin\omega t + B\cos\omega t = E\sin(t+\theta)$$

where $\theta = \tan^{-1}(A/B)$

$C = (A^2 + B^2)^{1/2}$

∴ Steady part becomes

$$\frac{1}{10}\sin t + \frac{1}{10}\cos t = k\sin(t+q)$$



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Name

- ASSIGNMENT.m
- EEE235Graph.m
- ENG 381 Assign 1 question 2.m
- Ex1.m
- Ex2.m
- Ex2.mat
- Ex3.m
- Ex3Isaiah.m
- Ex3Isaiahassignment.m
- Ex4.m
- Ex4Johnson.m
- Ex5.m
- Ex6.m
- Ex7.m
- Ex8.m
- Ex9.m

Details

Workspace

Name | Value

Editor - C:\Users\BROOKSTONE SCHOOL\Documents\MATLAB\semiloremath.m

QUESTION4b.m | QUESTION4c.m | Ex10.m | QUESTION4a.m | Question1.m | EEE235Graph.m | semiloremath.m | semiloreelectmachines.m

```
1 -  commandwindow
2 -  clear
3 -  clc
4 -  close all
5 -  syms t
6 -  x =(1/10)*(-exp(-2*t) + exp(-3*t) + sin(1*t) + cos(1*t))
7 -  ts=(0:0.01:15)
8 -  xs=subs(x,ts)
9 -  figure (1)
10 -  plot(ts,xs)
11 -  xlabel('Time(seconds)')
12 -  ylabel('Vibrations')
13 -  grid on
14 -  grid minor
15 -  axis tight
```

Command Window

```
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MathWorks to renew this license.
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fx >>
```

Ready | script | Ln 13 | Col 8

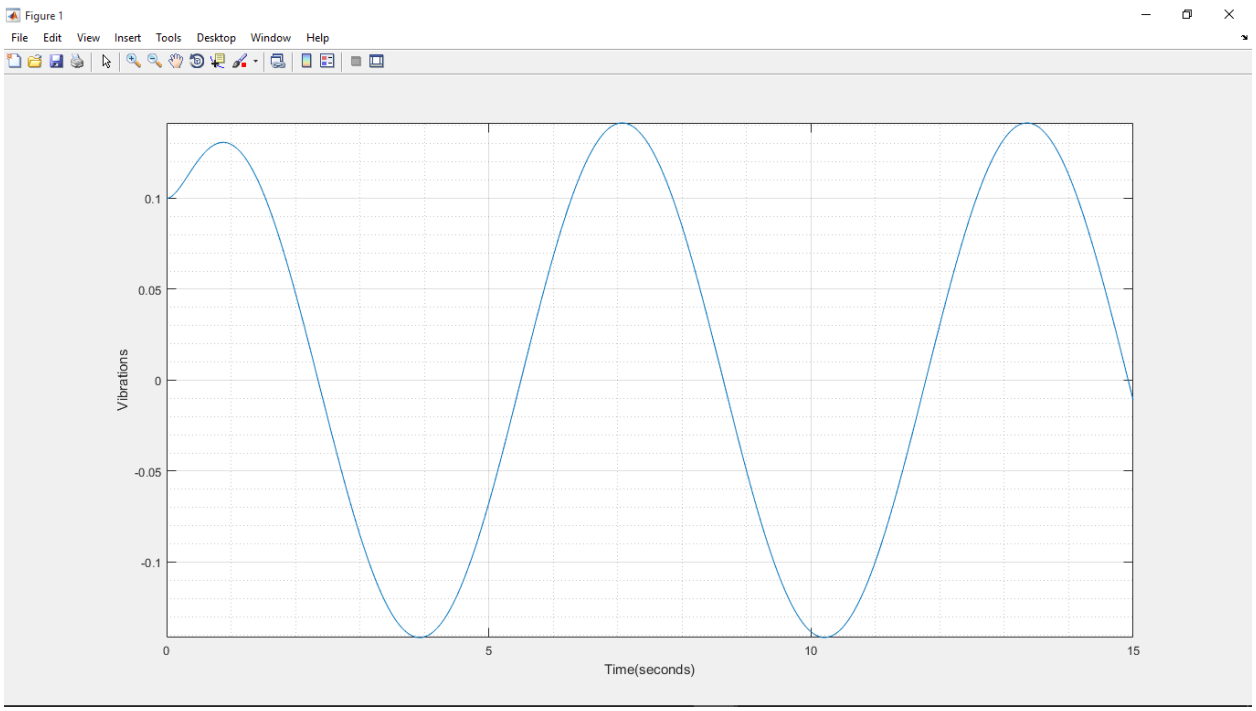
Figure 1
File Edit View Insert Tools Desktop Window Help
0.1
0.05
0
-0.05
-0.1
Vibrations
0
5
10
15
Time(seconds)