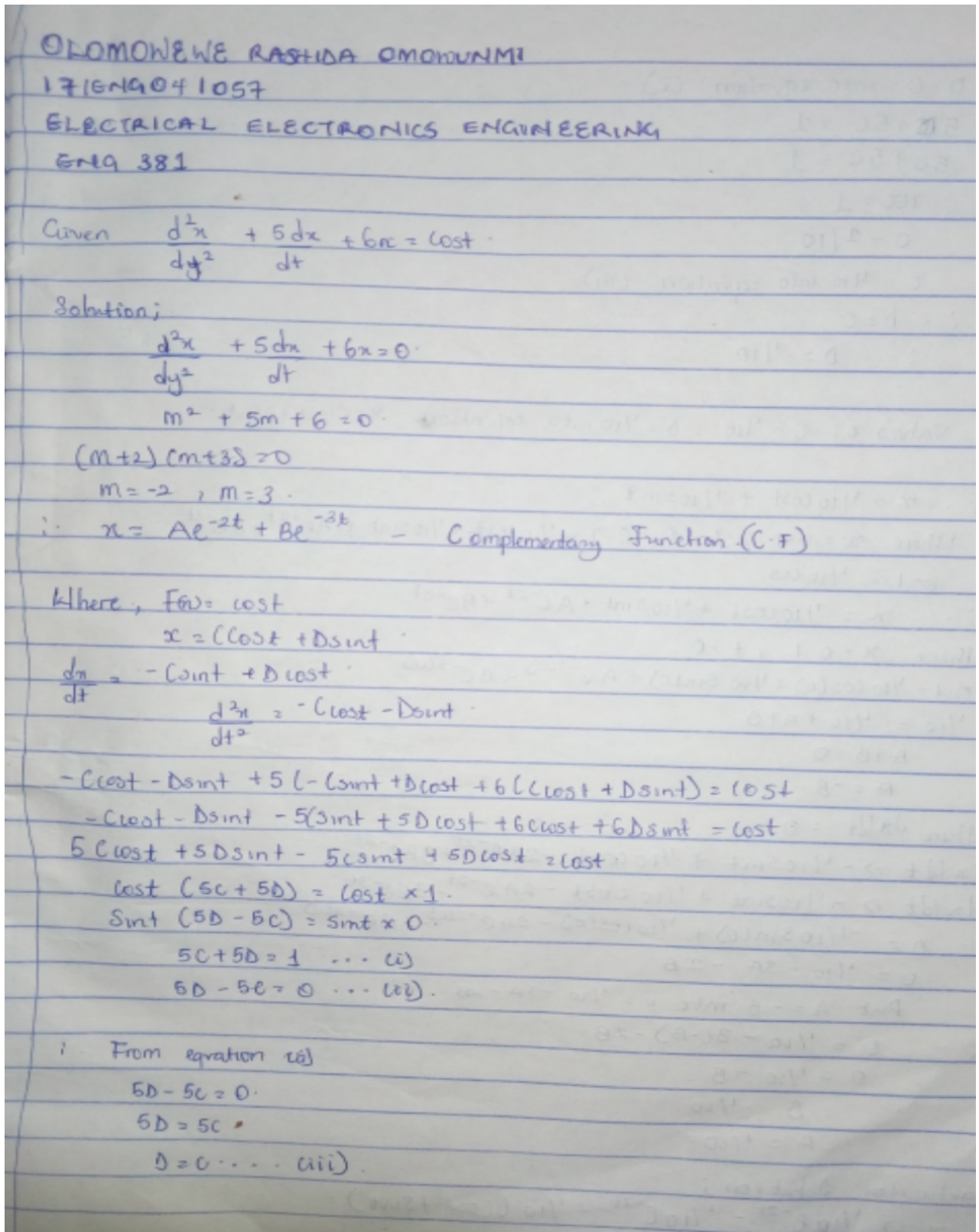


OLOMOWEWE RASHIDA OMOWUNMI
 17/ENG04/057
 ELECTRICAL ELECTRONICS ENGINEERING
 ENG 381 (ENGINEERING MATHEMATICS ASSIGNMENT)
 ASSIGNMENT SOLUTION:

Question 1:



∴ Put $D=C$ into equation (i)

$$∴ 5C + 5C = 1$$

$$∴ 5C + 5C = 1$$

$$10C = 1$$

$$C = 1/10$$

∴ Put $C = 1/10$ into equation (iii)

$$∴ D = C$$

$$∴ D = 1/10$$

∴ Put values of $C = 1/10$, $D = 1/10$ into equation $x = C \cos t + D \sin t$

$$∴ x = 1/10 \cos t + 1/10 \sin t$$

∴ Where $x = 0$ at $t = 0$. G.I. $= 1/10 \cos t + 1/10 \sin t + A e^{-2t} + B e^{-3t}$

$$∴ \text{or } 1 = 1/10 \cos 0$$

$$∴ x = 1/10 \cos t + 1/10 \sin t + A e^{-2t} + B e^{-3t}$$

Where $x = 0$ at $t = 0$

$$0 = 1/10 \cos 0 + 1/10 \sin 0 + A e^{-2 \cdot 0} + B e^{-3 \cdot 0}$$

$$1/10 = 1/10 + A + B$$

$$A + B = 0$$

$$A = -B$$

Where $dx/dt = 0$

$$∴ dx/dt \Rightarrow -1/10 \sin t + 1/10 \cos t - 2A e^{-2t} + 3B e^{-3t}$$

$$dx/dt \Rightarrow -1/10 \sin t + 1/10 \cos t - 2A e^{-2t} - 3B e^{-3t}$$

$$∴ 0 = -1/10 \sin 0 + 1/10 \cos 0 - 2A e^{-2 \cdot 0} - 3B e^{-3 \cdot 0}$$

$$0 = 1/10 - 3A - 2B$$

$$\text{Put } A = -B \text{ into } 0 = 1/10 - 3A - 2B$$

$$∴ 0 = 1/10 - 3(-B) - 2B$$

$$0 = 1/10 + B$$

$$B = -1/10$$

$$A = 1/10$$

Particular Solution;

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

Question 2:

CODE:

1. commandwindow
2. clear
3. clc
4. close all
5. syms t
6. t=0:0.1:15
7. $x=(1/10*\exp(-3*t)-1/10*\exp(-2*t)+1/10*\cos(t)+1/10*\sin(t))$
8. plot(t,x)
9. xlabel("particular integral")
10. ylabel("function")
11. grid on
12. grid minor

GRAPH:

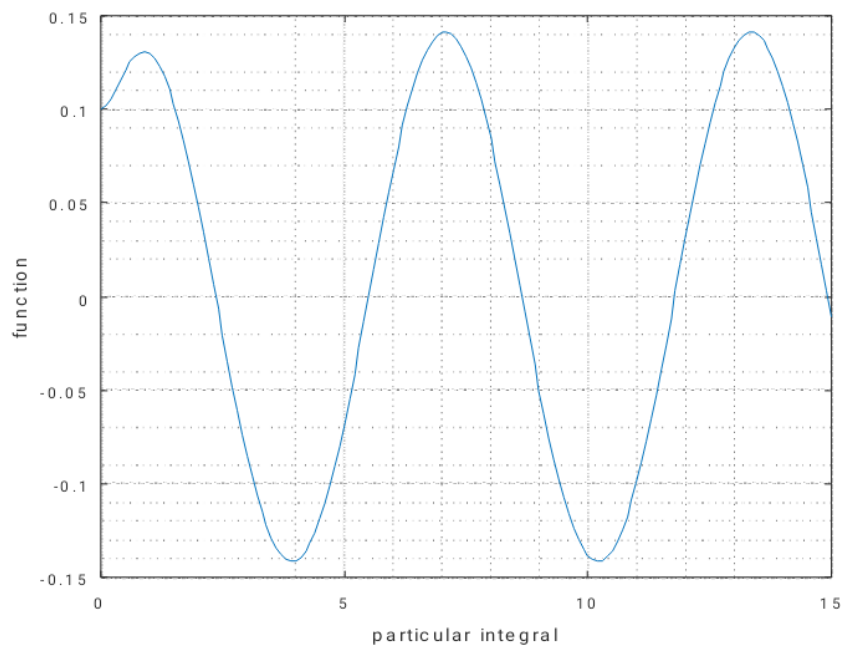


Figure 1: GRAPH REPRESENTING THE RELATIONSHIP BETWEEN X AND T

OUTPUT:

t =
Columns 1 through 10

0 0.1000 0.2000 0.3000 0.4000 0.5000 0.6000 0.7000 0.8000 0.9000

Columns 11 through 20

1.0000 1.1000 1.2000 1.3000 1.4000 1.5000 1.6000 1.7000 1.8000 1.9000

Columns 21 through 30

2.0000 2.1000 2.2000 2.3000 2.4000 2.5000 2.6000 2.7000 2.8000 2.9000

Columns 31 through 40

3.0000 3.1000 3.2000 3.3000 3.4000 3.5000 3.6000 3.7000 3.8000 3.9000

Columns 41 through 50

4.0000 4.1000 4.2000 4.3000 4.4000 4.5000 4.6000 4.7000 4.8000 4.9000

Columns 51 through 60

5.0000 5.1000 5.2000 5.3000 5.4000 5.5000 5.6000 5.7000 5.8000 5.9000

Columns 61 through 70

6.0000 6.1000 6.2000 6.3000 6.4000 6.5000 6.6000 6.7000 6.8000 6.9000

Columns 71 through 80

7.0000 7.1000 7.2000 7.3000 7.4000 7.5000 7.6000 7.7000 7.8000 7.9000

Columns 81 through 90

8.0000 8.1000 8.2000 8.3000 8.4000 8.5000 8.6000 8.7000 8.8000 8.9000

Columns 91 through 100

9.0000 9.1000 9.2000 9.3000 9.4000 9.5000 9.6000 9.7000 9.8000 9.9000

Columns 101 through 110

10.0000 10.1000 10.2000 10.3000 10.4000 10.5000 10.6000 10.7000 10.8000
10.9000

Columns 111 through 120

11.0000 11.1000 11.2000 11.3000 11.4000 11.5000 11.6000 11.7000 11.8000
11.9000

Columns 121 through 130

12.0000 12.1000 12.2000 12.3000 12.4000 12.5000 12.6000 12.7000 12.8000
12.9000

Columns 131 through 140

13.0000 13.1000 13.2000 13.3000 13.4000 13.5000 13.6000 13.7000 13.8000
13.9000

Columns 141 through 150

14.0000 14.1000 14.2000 14.3000 14.4000 14.5000 14.6000 14.7000 14.8000
14.9000

Column 151

15.0000

x =

Columns 1 through 10

0.1000 0.1017 0.1057 0.1109 0.1162 0.1212 0.1254 0.1285 0.1303 0.1307

Columns 11 through 20

0.1296 0.1271 0.1231 0.1177 0.1110 0.1030 0.0938 0.0836 0.0724 0.0604

Columns 21 through 30

0.0477 0.0345 0.0209 0.0070 -0.0069 -0.0209 -0.0346 -0.0481 -0.0611 -0.0735

Columns 31 through 40

-0.0851 -0.0959 -0.1058 -0.1147 -0.1223 -0.1288 -0.1340 -0.1379 -0.1403 -0.1414

Columns 41 through 50

-0.1411 -0.1393 -0.1362 -0.1317 -0.1259 -0.1188 -0.1106 -0.1012 -0.0909 -0.0796

Columns 51 through 60

-0.0675 -0.0548 -0.0415 -0.0278 -0.0138 0.0003 0.0144 0.0284 0.0421 0.0554

Columns 61 through 70

0.0681 0.0801 0.0913 0.1017 0.1110 0.1192 0.1262 0.1319 0.1364 0.1394

Columns 71 through 80

0.1411 0.1414 0.1402 0.1377 0.1337 0.1285 0.1219 0.1142 0.1052 0.0953

Columns 81 through 90

0.0844 0.0726 0.0602 0.0471 0.0335 0.0196 0.0056 -0.0086 -0.0226 -0.0364

Columns 91 through 100

-0.0499 -0.0629 -0.0752 -0.0868 -0.0975 -0.1072 -0.1159 -0.1234 -0.1297 -0.1347

Columns 101 through 110

-0.1383 -0.1406 -0.1414 -0.1409 -0.1389 -0.1355 -0.1308 -0.1248 -0.1175 -0.1091

Columns 111 through 120

-0.0996 -0.0890 -0.0776 -0.0654 -0.0526 -0.0392 -0.0255 -0.0114 0.0027 0.0168

Columns 121 through 130

0.0307 0.0444 0.0575 0.0702 0.0821 0.0931 0.1033 0.1124 0.1204 0.1272

Columns 131 through 140

0.1328 0.1370 0.1398 0.1412 0.1413 0.1399 0.1371 0.1329 0.1275 0.1207

Columns 141 through 150

0.1127 0.1036 0.0935 0.0825 0.0706 0.0580 0.0448 0.0312 0.0173 0.0032

Column 151

-0.0109

Question 3:

c) Write the steady-state solution of the model in form of $x = K \sin(\omega t + a)$.

i. Where the steady state equation is P.I of the General Solution;

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

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

Substitute $j \frac{\sqrt{2}}{\sqrt{2}} = 1$ into equation (i).

$$x = \frac{1}{10} \left[\frac{\cos \frac{\sqrt{2}}{\sqrt{2}} t}{\sqrt{2}} + \frac{\sin \frac{\sqrt{2}}{\sqrt{2}} t}{\sqrt{2}} \right]$$

$$\therefore x = \frac{\sqrt{2}}{10} [\cos t (\frac{1}{\sqrt{2}}) + \sin t (\frac{1}{\sqrt{2}})]$$

Recall that $\sin 45 = \cos 45 = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$

$$x = \frac{\sqrt{2}}{10} (\cos + \sin(45) + \sin t (\cos(45)))$$

$$x = \frac{\sqrt{2}}{10} (\sin(t + 45)) \dots \dots \text{ii)}$$

Recall $\sin(a+b) \Rightarrow \cos a \sin b + \sin a \cos b$

Where $\pi/4 = 45$.

s. Substitute $\pi/4 = 45$ into eq (ii).

$$x = \frac{\sqrt{2}}{10} [\sin(t + \pi/4)] \dots \dots \text{iii)}$$

\therefore From steady state eqn = Equation (iii)

$$\therefore \frac{\sqrt{2}}{10} [\sin(t + \pi/4)] = K \sin(t + a)$$

$$\therefore K = \frac{\sqrt{2}}{10}, \quad a = \pi/4$$