



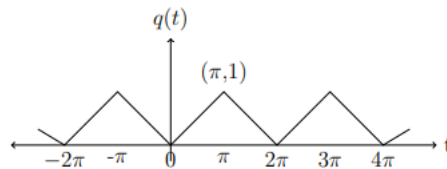
MAT 2002 DA-2



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Experiment 2A:

1. The charge $q(t)$ with periodicity 2π on the plates of a capacitor at time t is shown in the following figure. Express $q(t)$ as a Fourier series expansion in the interval $[0, 2\pi]$



Code:

```
EDITOR    PUBLISH    FILE VERSIONS    VIEW    Search (Ctrl+Shift+Space)
Code Issues    Run Section    Section Break    Run and Advance    Run    Step    Stop
ANALYZE    SECTION    RUN

Fourier1.m x    Fourier2.m x    Fourier1Assign.m x    untitled2 x    +
/MATLAB Drive/Fourier1Assign.m

1    clc
2    clear all
3    close all
4    syms x
5    f=piecewise(0<x<3.14159,0.31831*x,3.14159<x<6.28318,-0.31831*x+2);
6    I=[0 6.28318];
7    N=input('Enter number of harmonics');
8    T=I(2)-I(1);
9    w=(2*pi)/T;
10   a0=(2/T)*int(f,x,I(1),I(2));
11   FS=a0/2;
12   for i=1:N
13       an(i)=(2/T)*int(f*cos(i*w*x),x,I(1),I(2));
14       bn(i)=(2/T)*int(f*sin(i*w*x),x,I(1),I(2));
15       FS=FS+an(i)*cos(i*w*x)+bn(i)*sin(i*w*x);
16   end
17   disp('Fourier series of f(x) is:');
18   disp(vpa(FS,4));
19   fplot(f,[I(1),I(2)]);
20   hold on
21   fplot(FS,[I(1),I(2)]);
22   hold off
23   legend('Function Plot','Fourier Series')

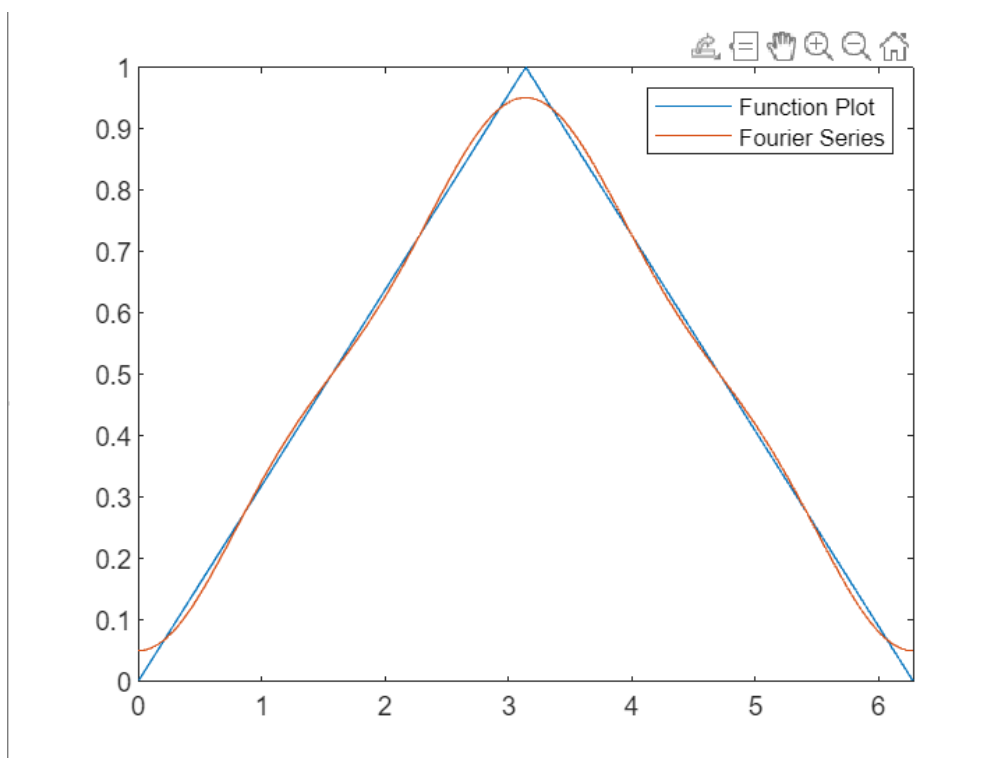
COMMAND WINDOW    UTF-8    CRLF    script    Ln 9 Col 12
Search    [Icons]    21:19    01-04-2023
```

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Output:

```
Enter number of harmonics
3
Fourier series of f(x) is:
6.665e-19*cos(2.0*x) - 0.4053*cos(1.0*x) - 6.202e-7*sin(1.0*x) - 0.04503*cos(3.0*x) - 2.067e-7*sin(3.0*x) + 0.5
```

Function Plot:

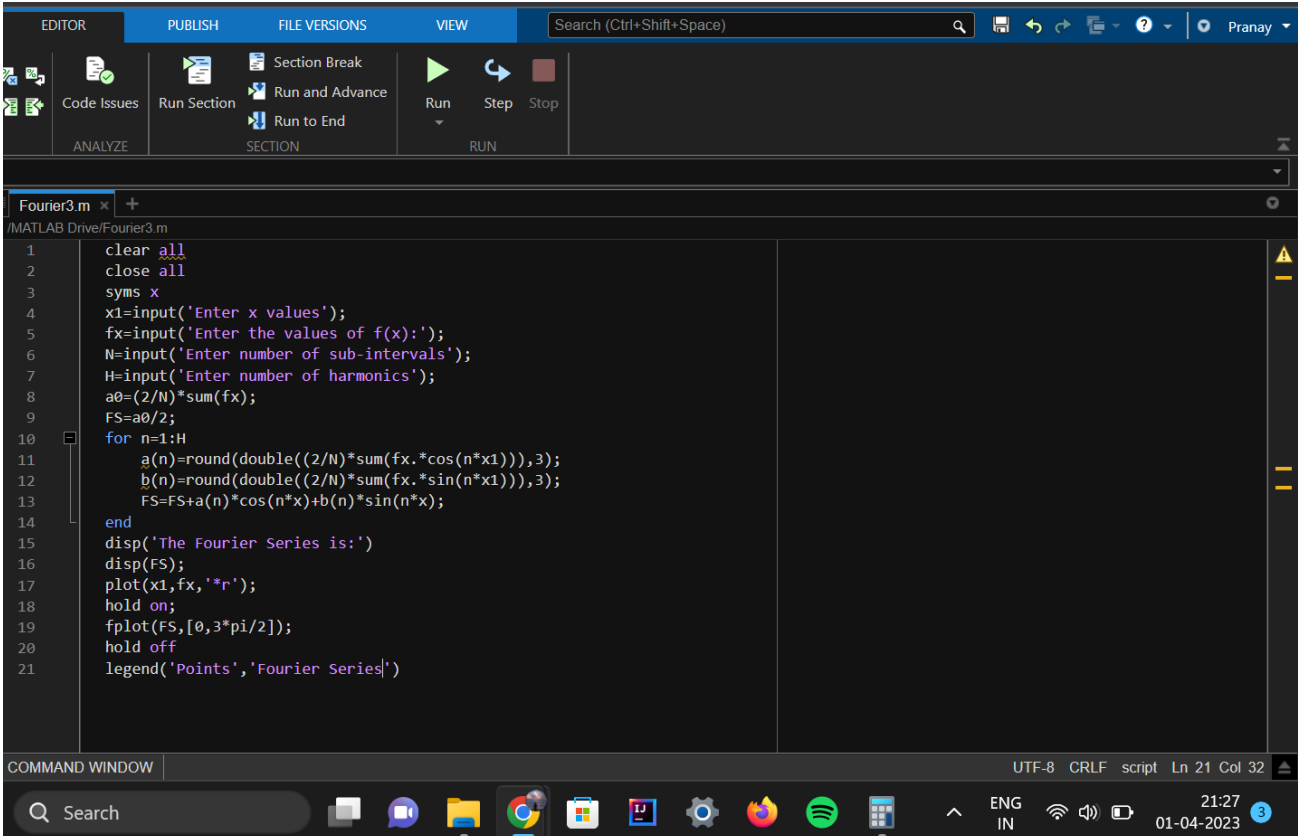


Experiment 2B:

1. Find the first two harmonics for the following data

t	0	$\pi/2$	π	$3\pi/2$
f(t)	-1	2	-3	4

Code:



The screenshot shows the MATLAB R2022a environment. The Editor window displays a script named 'Fourier3.m' with the following code:

```
1 clear all
2 close all
3 syms x
4 x1=input('Enter x values');
5 fx=input('Enter the values of f(x):');
6 N=input('Enter number of sub-intervals');
7 H=input('Enter number of harmonics');
8 a0=(2/N)*sum(fx);
9 FS=a0/2;
10 for n=1:H
11     a(n)=round(double((2/N)*sum(fx.*cos(n*x1))),3);
12     b(n)=round(double((2/N)*sum(fx.*sin(n*x1))),3);
13     FS=FS+a(n)*cos(n*x)+b(n)*sin(n*x);
14 end
15 disp('The Fourier Series is:')
16 disp(FS);
17 plot(x1,fx,'*r');
18 hold on;
19 fplot(FS,[0,3*pi/2]);
20 hold off
21 legend('Points','Fourier Series')
```

The Command Window at the bottom shows the status 'UTF-8 CRLF script Ln 21 Col 32'. The Windows taskbar at the very bottom shows the system clock as 21:27 on 01-04-2023.

Output:

```
Enter x values
[0 pi/2 pi 3*pi/2]
Enter the values of f(x):
[-1 2 -3 4]
Enter number of sub-intervals
4
Enter number of harmonics
2
The Fourier Series is:
 $\cos(x) - 5\cos(2x) - \sin(x) + 1/2$ 
```

Function Plot:

