GALGOTIAS UNIVERSITY

PLOT NO.2, SECTOR – 17 A, YAMUNA EXPRESSWAY,
GREATER NOIDA, GAUTAM BUDH NAGAR, U.P INDIA

SCHOOL OF COMPUTING SCIENCE AND ENGINEERING

SUBJECT :SCI LAB PROGRAMME :B.Tech

Subject code : BCS01T1001 Semester :1st

Submitted to :

Submitted By :

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Section : 24 (P1)

S. No.	List of Experiments
1.	Overview, Basic syntax, Mathematical Operators, Predefined constants, Built in functions at **SCILAB** platform.

2.	Write a **SCILAB** code to find addition, subtraction, multiplication and division of two matric transpose of a matrix and inverse of a non singular matrix.
3.	Write a SCILAB code for programming -Functions - Loops - Conditional statements - Handl .sci files.
4.	Write a SCILAB code for 2-D : circle, parabola, ellipse and hyperbola and 3-D surfaces: Plan Sphere, Cylinder, Paraboloid, Ellipsoid, Hyperboloid, cone.
5.	Write a **SCILAB** code to find expansion of functions in Taylor series.
6.	Write a **SCILAB** code for Fourier series expansion of different wave forms and comparison w the original function.

Experiment-1:

To write a SCILAB -CODE for Arithmetic Operations (on scalars and variables)and Elementary Math Built-in functions.

Objectives:

- ***To explain what is Scilab.***
- ***To download and install Scilab software in PC?***
- ***To explain how to work in the main window of Scilab called console***

- *To explain how Scilab works as a calculator: Arithmetic Operations with scalars(numbers)*
- *To explain some elementary Math Build-in functions in scilab library*
- *To explain the variables in Scilab.*
- *To explain how to work in Scilab editor and write Script Files.*

Exercises

To write a Scilab code to find the solution of following problems:

- **Evaluate**

(i) 271/3+320.2 , (ii) sqrt 64 + e^4 (iii)

(iv) **4!+ln2+log100,** ***(v) (2+3i)(4+5i)***

- **By assigning values 2 and 5 to variables a and b respectively, compute (i)c=(a+b)2**

(ii) d=4a-3b+lna+ **c2**

- ***Write the script file for the problem:***

The radius of a circle is 2cm. Find its area.

Solutions

Exc1 - **271/3+ 320.2**

Input :

```
clc clear
//exc1
a=27^(1/3)+32^0.2
b=sqrt(64)+exp(4)
```

Output :

a= 5.

b= 62.59815

c= 1.

d= 26.693147

Exc 2. – **Sqrt 64 + e^4**

Input :

clcclear

x= sqrt(64) y= %e^4 z= x+ydisp(z)

Output:

62.598150

iii)

Input :

clc clear

x= sin(%pi/6) y= cosd(60) z= x+ydisp(z)

Output :

1.

iv) 4!+1n2+log100

Input:

clc clear

a= factorial(4)

b= log(2)

c= log 10(100) z=a+b+cdisp(z)

Output :

26.693147

(v) (2+3i)(4+5i)

Input:

```
clc clear
a= 2+3*%ib= 4+5*%ic= a*b disp(c)
```

Output :

-7. + 22.i

Q2) . By assigning values 2 and 5 to variables a and b respectively , compute

- **$c=(a+b)^2$input**

Input *:*

```
clc clear a=2
b=5
c= (a+b)^2
d= (4*a)-(3*b)+log(a)+(c^2) disp(“c=”,c)
disp(“d=”,d)
```

Output :

“c=”

49.

“d=”

2394.6931

Q3). Write the script for the problem:

The radius of the circle is 2cm. Find its area.

Input *:*

r=2;

clc clear r=2

A=%pi*r^2

disp(“Area=”,A)

Output:

“Area=” 12.566371

Experiment 2

Objectives:

2.1] Creating 1-d in arrays(vectors).

2.1.1]creating a vector from a known list of numbers.

2.1.2]Creating a vector with constant spacing by specifying the first term, the spacing and the last term.

2.1.3]Creating a vector with linear(equal) spacing by specifying the first and last terms, and the number of terms.

2.2] Creating two-dimensional arrays(Matrix) 2.3] Mathematical operations with arrays 2.4] Finding roots of apolynomial

To write a Scilab code to find the solution of following problems:

1.(i) Create arow vectorwith3elements.

Input

x =[6 7 8]

disp(x)

Output

6. 7. 8.

(ii) create a column vector with 4 elements

Input

y = [6 ;7 ; 8 ; 9 ;]

disp(y)

Output

6.

7.

8.

9.

- By taking first term a=1 and the last term b=10 create aone dimensional array:
  - by taking the spacing between two consecutive termsd=2

Input clc clear a=1

b=10

d=2 r=[a:d:b] disp(r)

Output

1.3.5. 7. 9.

- by taking the Input: number of terms n=12

Input clc clear a=1 b=10 n=12

r=linspace(a,b,n) disp(r)

Output

column 1 to 9

1. 1.8181818 2.6363636 3.4545455 4.2727273

5.0909091 5.9090909 6.7272727 7.5454545

column 10 to 12

8.3636364 9.1818182 10.

- Create two row vectors (one dimensional arrays) a and b such that the following operations are defined and hence find:
- 2a-3b

Input

clc clear

A=[4 5 6]

B=[1 2 3] R=(2*A)-(3*B)

disp(R) **Output** 5. 4. 3.

- 2(transpose a)-3(transposeb)

Input

clc clear

A=[4 5 6]

B=[1 2 3] R=(2*A')-(3*B')

disp(R)

Output

5.

4.

3.

- Create two matrices(two dimensional arrays) A and B such that the following operations are defined and hence:

(i) $3A-AB^t$ Input

```
clc
clear
A=[7 5;2 4]
B=[8 6;1 9] R=3*A-A*B'
disp(R)
```

Output

-65.-37.

-34.-26.

- Create a matrix A so that the following operationsare defined andfind:
- determinant ofA,
- Inverse of A,
- product of A and inverse of A

Input

```
clc clear

A=[5 7 6;9 4 3;1 5 6]

disp("(i) Determinant=", det(A), "(ii) Inverse=", inv(A)) disp("(iii) Product of A and inverse of A", A*inv(A))
```

Output

"(i) Determinant="

-66.

"(ii) Inverse="

-0.1363636	0.1818182	0.0454545
0.7727273	-0.3636364	-0.5909091
-0.6212121	0.2727273	0.6515152

"(iii) Product of A and inverse of A"

1. 4.441D-16 8.882D-16

-4.441D-16 1. 4.441D-16

-4.441D-16 2.220D-161.

- Find the roots of followingpolynomials: (i) x2-x-2=0

Input clc

clear

A=[1 -1 -2]

disp("Roots of A=",roots(A))

Output

"Roots ofA=" 2. +0.i

-1. +0.i

```
clear
A=[1 -1 -2]
disp("Roots of A=",roots(A))
```

Output

```
"Roots ofA=" 2. +0.i
-1. +0.i
```

```
clear
A=[1 -1 -2]
disp("Roots of A=",roots(A))
```

Output

```
"Roots ofA=" 2. +0.i
-1. +0.i
```

Experiment-3

Write a SCILAB -CODE for programming: Functions - Conditional statements-loops in Scilab

- ***Objectives:***

Input function, conditional statements, loops and user defined functions

- Inputfunction
- Conditional statements
  - the if-endstructure
  - the if-else-endstructure
  - the if-elseif-else-endstructure
- loops
  - for-endloop
  - while-endloop
- user definedfunction

- ***Exercises:***

(All exercises to be solved on scinotes) Write a Scilab code in a script file:

Q1] To find volume and total surface area of a cone using input function.

Q2] To find whether an integer entered by user is odd or even, using if- else-end command.

Q3] To find whether a real number entered by user is negative, zero or a positive using if- elseif- else-end command.

Q4] To find the sum of squares of the first nnatural numbers, using forloop.

Q5] To find the sum of squares of the first n natural numbers, using while loop.

Q6] To find factorial of a numberusingfor loop.
Q7] To find factorial of a number using whileloop.

Q8] To find first n terms of Fibonacci sequence using for loop

Q9] To find volume and total surface area of a cone using user defined function

- ***SOLUTION-***

- ***Input***

//volume of cone-1/3%pi*R*R*H*

clc clear

r=input("enter r=") h=input("enter h=") v=1/3*%pi*r*r*h disp("volume of cone",v)

Output enter r=3 enter h=4

"volume of cone" 37.699112

*//total surface area of cone-%pi*R*(R+L)*

- Input

clc clear

r=input("enter r=") L=input("enter L=")
T=%pi*r*(r+L)

disp("total surface area of cone",T)

Output:

enter r=3 enterL=5

"total surface area of cone" 75.39882

- Input

//display an integer is even or odd

```
clc clear
a=input("enter the number=")
if(modulo(a,2)==0)then
disp("a is even"); else
disp("a is odd"); end
```

Output

enter the number=12 "a is even"

- *Input*

```
clc clear
n=input("enter a number=") if n>0 then
disp("The number is positive") elseif n==0
disp("you entered zero") else
disp("The number is negative") end
```

Output:

enter a number=8

"The number is positive"

- **(i)*Input:***

```
Clc clear n=0
a=input("Enter number of terms= ") s=0
for n=(1:a) s=s+(n^2) end
disp("Sum= ",s)
```

Output:

```
Enter number of terms= 6
```

```
"Sum= " 91.
```

- *Input:*

```
clc clear
n=input("Enter no. of tearms") i=1
s=0
while i<=n; s=s+(i^2); i=i+1;
```

end disp("sum=",s) ***Output:***

Enter no. of tearms12 "sum="

650.

- Input:

Clc clear

n=input("Enter no. whose factorial is to be found: ") f=1

for(i=1:n) f=f*i;

end

disp("Factorial= ", f)

Output:

Enter no. whose factorial is to be found: 5

"Factorial= " 120.

- ***Input:***

clc clear

n=input("Enter no. whose factorial is to be found:") i=1

f=1

while i<=n; f=f*i; i=i

end disp("Factorial=")

Output:

Enter no. whose factorial is to be found: 8
"Factorial= "

40320.

- (i) Input:

clc clear

n=input("Enter no. of terms= ") s=(1:n)

s(1)=1;

s(2)=1;

for i= 3:n

s(i)=s(i-2)+s(i-1); end

disp(s)

Output:

Enter no. of terms= 10

column 1 to 9

1. 1. 2. 3. 5. 8. 13. 21. 34.

column 10

55.

- **Input:**

```
clc clear
function [v, TSA]=cone(r, h) v=%pi*(r^2)*h
TSA=%pi*(r^2) disp("Volume= ", v)
disp("Total Surface Area= ", TSA) endfunction
cone(6,12)
```

Output

"Volume= " 1357.1680

"Total Surface Area= " 113.09734

Experiment-4

Objective

4.1.1] 2d Plot of an Explicitly defined function:

- Basiccode

- Customization of plot: Point Style ,colour, andtitles
- Plotting two functions with same domain. The use oflegends
- Algorithm

4.1.2] 2d Plots of a function given in parametric form:

- Algorithm

4.1.3] 2d plot of implicitly defined function

- Algorithm

Exercise

- Write Scilab code in a scriptfile:

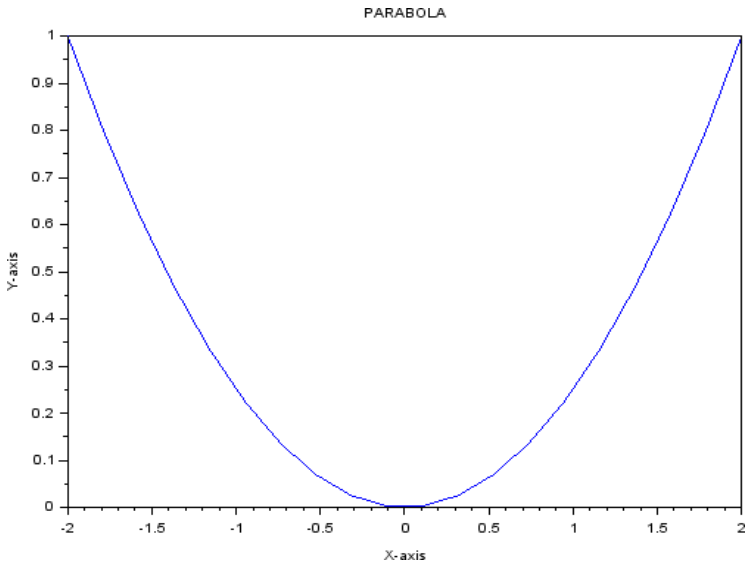
- **To plot Parabola $x^2=4ay$. Take focal lengtha=1.**
- **To plot Circle $x^2+y^2=a2$. Takea=1.**
- **To plot Ellipse $x^2/ a^2 + y^2/ b^2 =1$. Take a=4,b=3.**
- **Plot graph of y1=e x and y2=ln(x) in interval [0.5, 2].**
- **Plot rectangular parabola xy=1 in interval[0.5,2].**

Solutions:

- **Input :**

```
x=linspace(-2,2,20) y=x^2/4
plot (x,y)
xtitle("PARABOLA","X-axis","Y-axis")
```

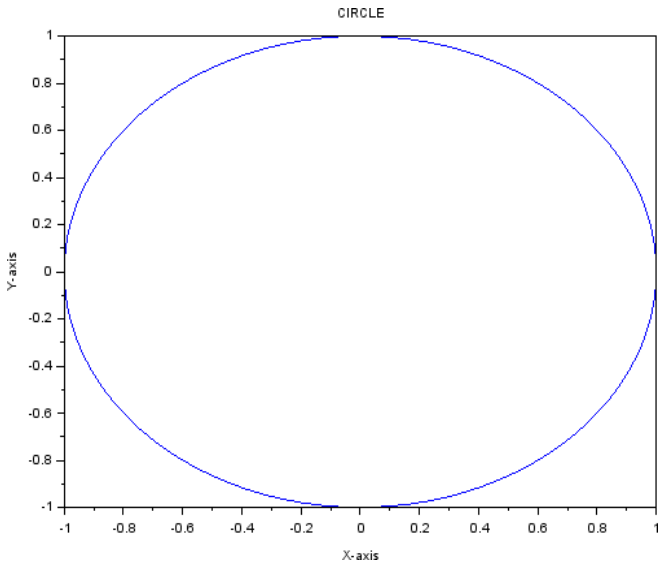
Output :



- **Input:**

```
clear clc
th=linspace(0,2*%pi) r=1
x=r.*cos(th) y=r.*sin(th) plot(x,y)
xtitle("CIRCLE","X-axis", "Y-axis")
```

Output:

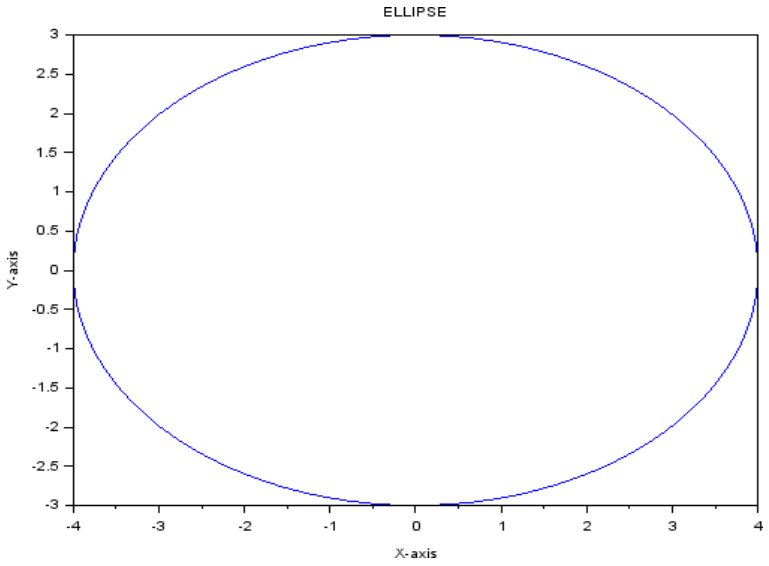


- **Input:**

```
clear clc
t=linspace(0,2*%pi) x=4.*cos(t) y=3.*sin(t)
plot(x,y)
```

xtitle("ELLIPSE","X-axis","Y-axis")

Output:



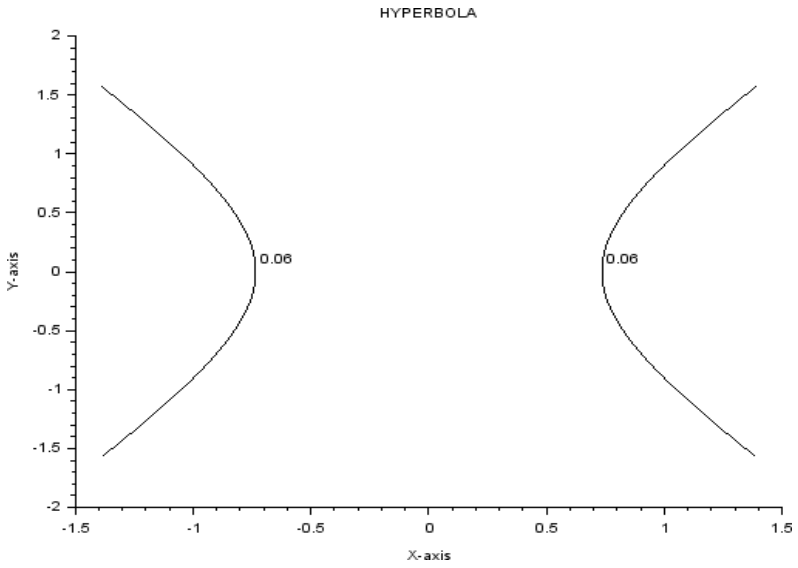
- **Input:**

clear clc

function [**f**]=hyperbola(**x**, **y**) [**f**]=**x**^2/9-**y**^2/16
endfunction

x=linspace(-%pi/2,%pi/2) y=linspace(-%pi/2,%pi/2) contour(x,y,hyperbola,1) xtitle("HYPERBOLA","X-axis","Y-axis")

Output:



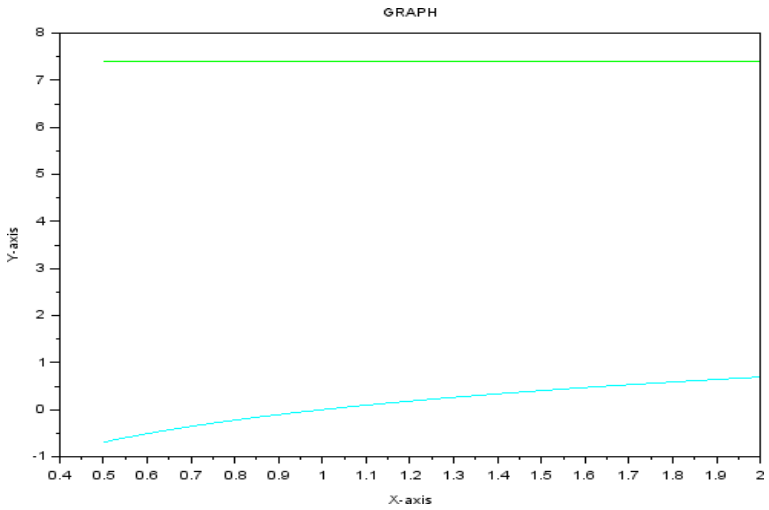
- **Input**:

clear clc

x=linspace(0.5,2) y1=%e^2 plot(x,y1,"g") y2=log(x) plot(x,y2,"c")

xtitle("GRAPH","X-axis","Y-axis")

Output:



- **Input:**

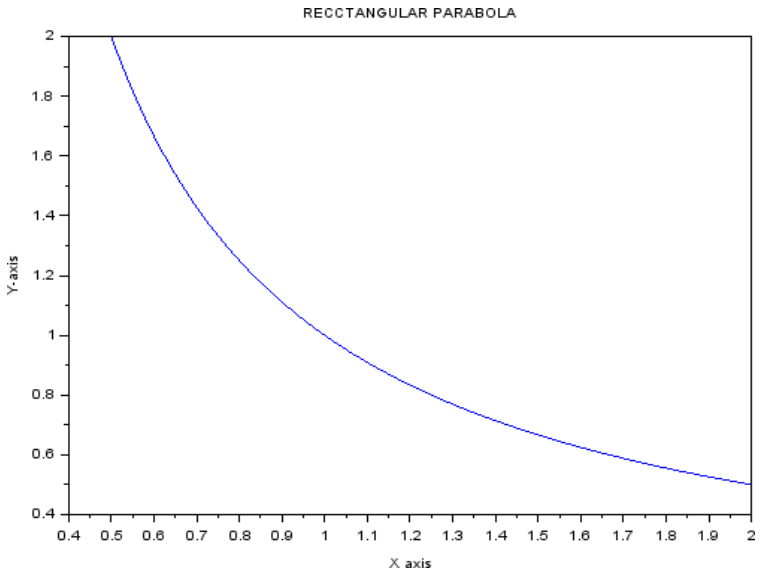
clear clc

x=linspace(0.5,2) y=1./x

plot(x,y)

xtitle("RECCTANGULAR PARABOLA","X-axis","Y-axis")

Output:



- Write Scilab code in a scriptfile:

- **To plot a Plane ax+ by +cz=d. Take a=b=-1, c=1, d=4.z=4+x+y.**
- **To plot Sphere $x^2+y^2+z^2=a^2$, Takea=1.**
- **To plot right circular Cylinder$x^2+y^2=a^2$.**
- **To plot parabloid$z/c= x^2/a^2+y^2/b^2$. Takea=b=c=1.**
- **To plot Ellipsoid $x^2/a^2+y^2/b^2+z^2/c^2=1$. Takea=4,b=3,c=2.**
- **To plot Hyperboloid $x^2/a^2+y^2/b^2-z^2/c^2=1$. Takea=4,b=3,c=2.**

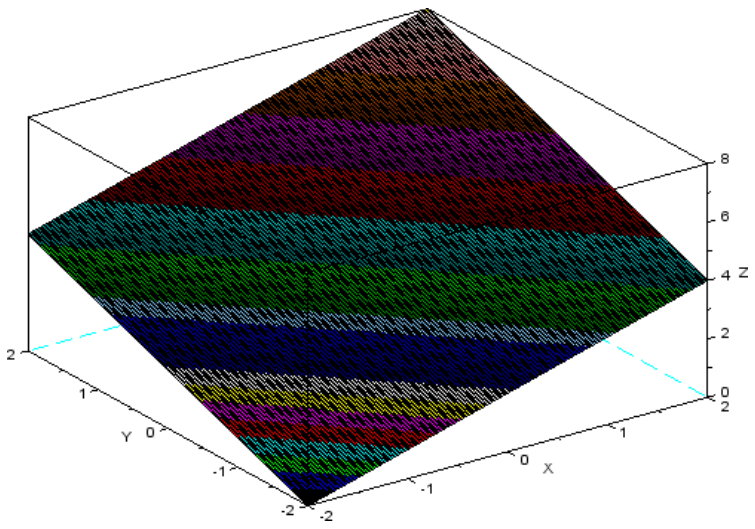
- **To plot (elliptical)Cone $(z/c)^2 = (x^2/a^2 + y^2/b^2)$. Take a=b=c=1.**

Solutions:

- ***Input :***

```
function z=f(x, y) z=4+x+y;
x=linspace(-2,2,100); y=linspace(-2,2,200);
z=feval(x,y,f)';
clf surf(x,y,z)
```

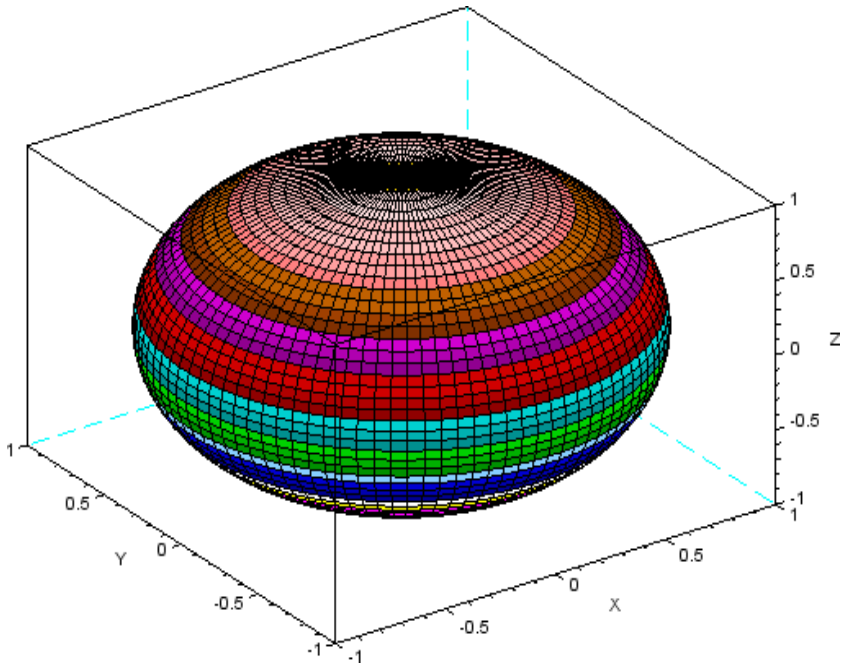
Output:



- **Input:**

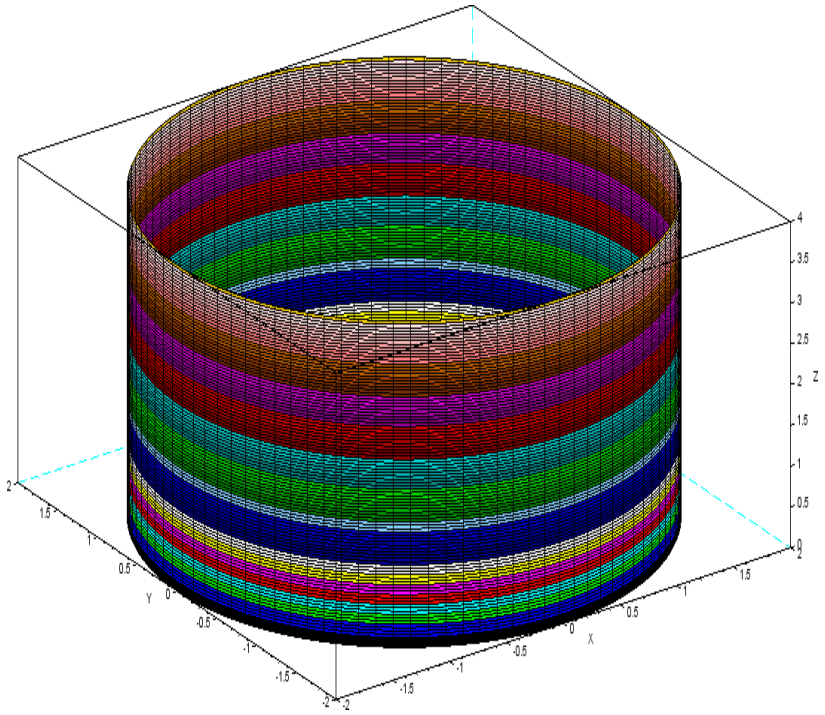
```
a =linspace(0,360,100); th=linspace(-90,90,50); R =1;
[A,Th]=meshgrid(a,th); Z = R*sind(Th);
X = R*cosd(Th).*cosd(A); Y = R*cosd(Th).*sind(A);
Ncolors=100;
clf surf(X,Y,Z)
```

Output:


1
0.5
0
-0.5
-1
Z
1
0.5
0
-0.5
-1
X
1
0.5
0
-0.5
-1
Y

- **Input :**t=linspace(0,2*%pi,100); x1=linspace(0,4,100); [T,X1]=meshgrid(t,x1); x=2*cos(T);y=2*sin(T);z=(X1); surf(x,y,z)

Output:

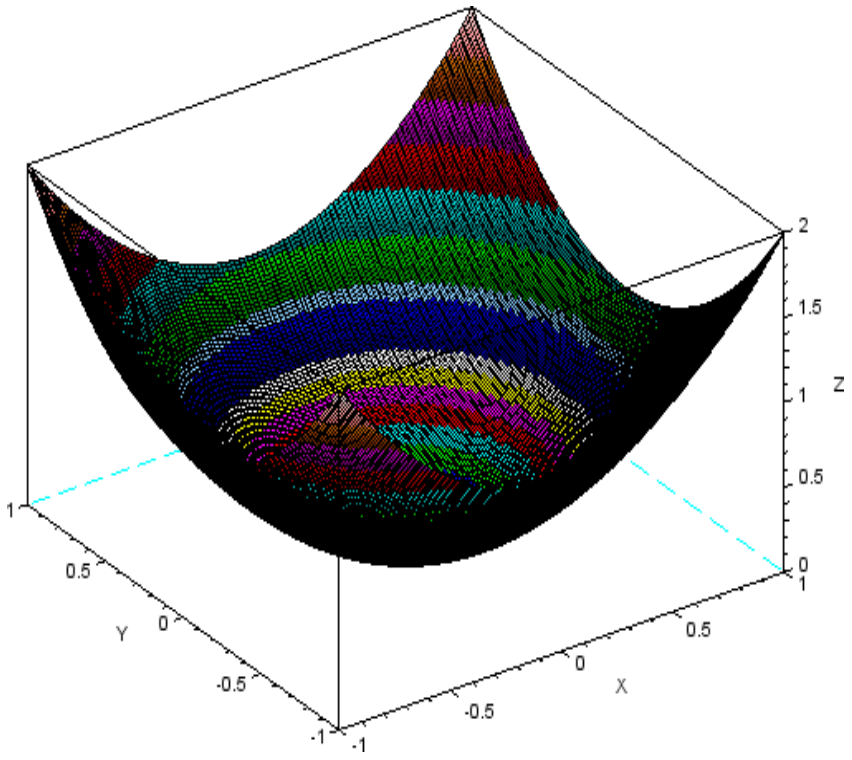


- **Input:**

function z=f(x, y) z=x^2+y^2; endfunctionx=linspace(-1,1,100); y=linspace(-1,1,200); z=feval(x,y,f)';

clf surf(x,y,z)

Output



- **Input:**

a =linspace(0,360,100); th=linspace(-90,90,50); R =1;

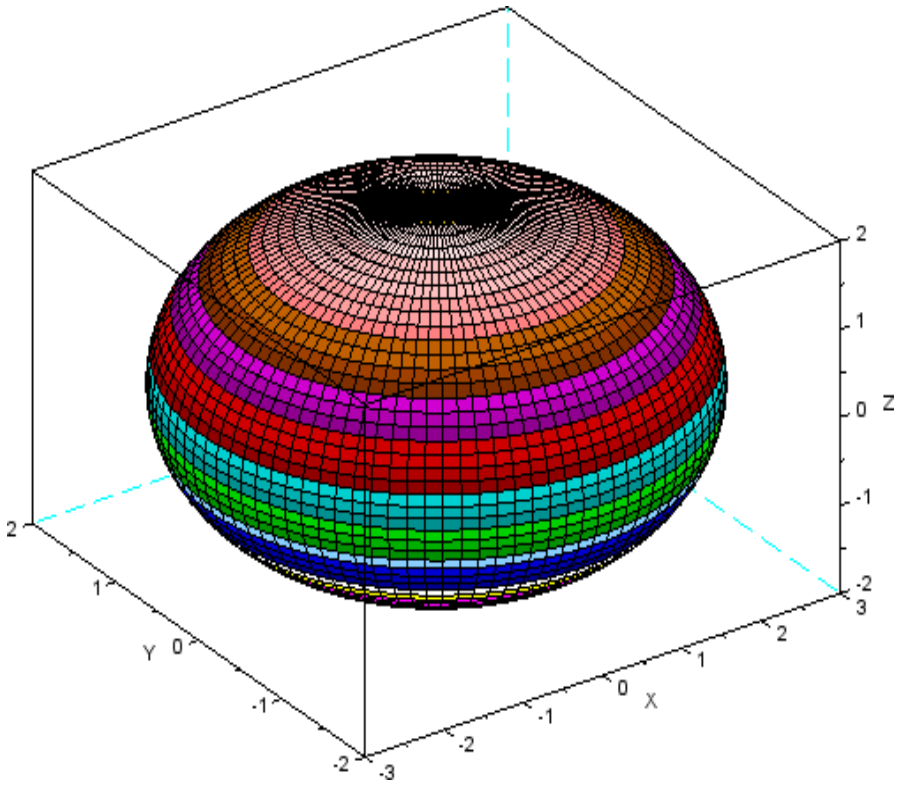
[A,Th]=meshgrid(a,th); Z =2*R*sind(Th);

X =3*R*cosd(Th).*cosd(A); Y =2*R*cosd(Th).*sind(A); Ncolors=100;

clf

surf(X,Y,Z)

Output:



- **Input:**

a =linspace(0,360,100); th=linspace(-90,90,50); R =1;

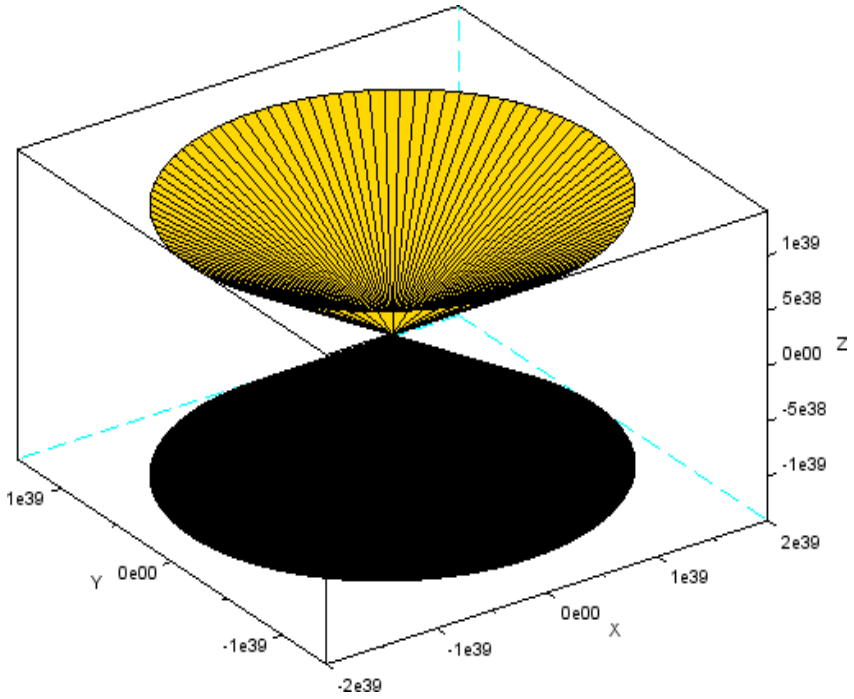
[A,Th]=meshgrid(a,th); Z =2*R*sinh(Th);

X =3*R*cosh(Th).*cosd(A); Y =2*R*cosh(Th).*sind(A); Ncolors=100;

clf

surf(X,Y,Z)

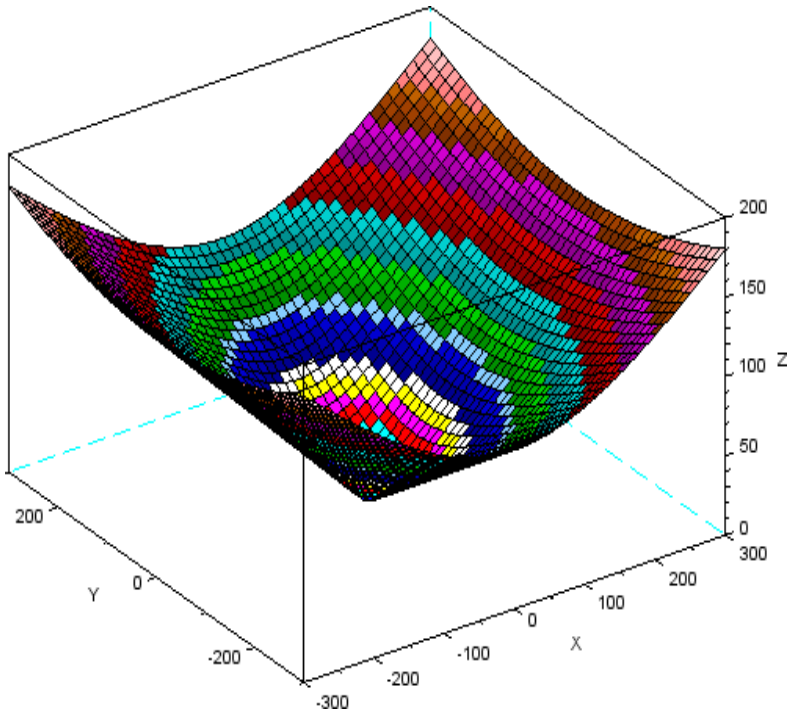
Output:



- **Input:**

```
function z=f(x, y) z=sqrt(x^2/4+y^2/9);
endfunction

x=linspace(-300,300,50); y=linspace(-300,300,50);
z=feval(x,y,f)';

clf surf(x,y,z)
```

Output:


200
150
100
50
0
Z
200
0
-200
Y
-300
-200
-100
0
100
200
300
X

EXPERIMENT 5

Objectives:

To write a SCILAB -CODE

5.1. To find the error in estimated value (yest) of a function f(x) at a point x using its Taylor series.

5.2. To compare a function f(x) and its Taylor series expansion using 2d plots.

Excercises

Write a Scilab code in a script file:

5.1.1] To find the***error***in estimating the value of functionf(x)=e^x at x=1 using its Taylor series expansion about origin.

5.1.2] To find the***error***in estimating the value of functionf(x)=sin(x) at x=pi/2 using its Taylor series expansion about origin.

5.2.1] To compare the function f(x)=$e^x$and its Taylor seriesexpansion about origin by using 2d plots

5.2.2] To compare the function f(x)=sin(x)and its Taylorseries expansion about origin by using 2d plots

Solution

5.1.1] Input:

```
clc;
clear;

a=0
x=1
y=%e^x

yest=0
n=1
for i=0:1:n
yest=yest+x^i/factorial(i)

end
disp(y)
disp(yest)

error=abs(y-yest)
```

```
disp(error)
```

Output:

```
2.7182818
```

2.

```
0.7182818
```

5.1.2] Input:

```
clc;

clear;

a=0

x=%pi/2
y=sin(x)
yest=0

n=10

for i=0:1:n

yest=yest+((-1)^i)*(x^(2*n+i)/factorial(2*n+1))
```

```
end

disp(y)

disp(yest)

error=abs(y-yest)

disp(error)
```

Output:

1.

9.211D-15

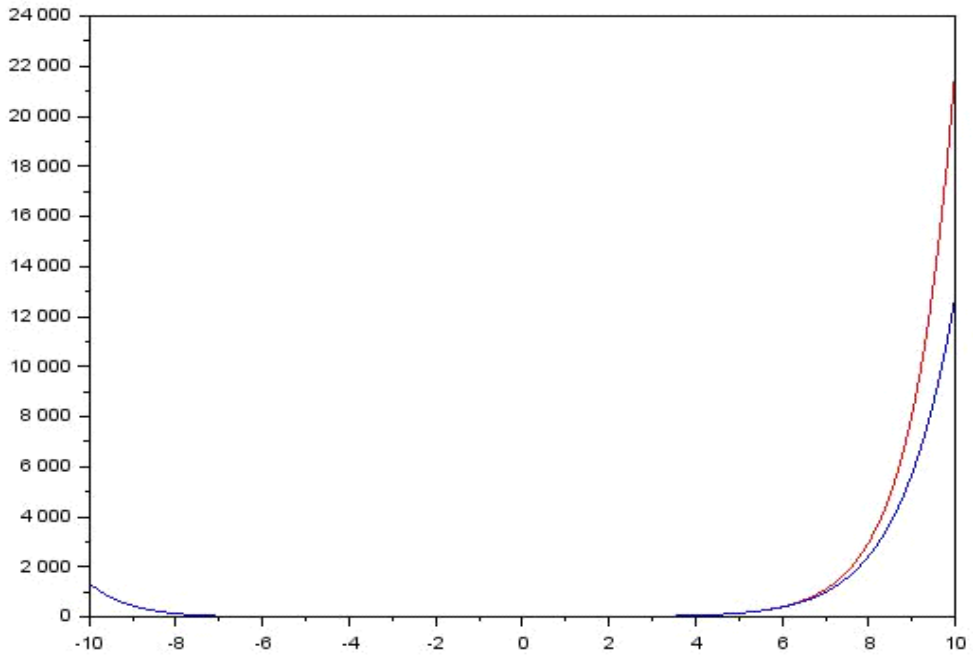
1.0000000

5.2.1] Input:

```
clc;
clear;
x=linspace(-10,10,100)
y=%e^x
yest=0
n=10

for i=0:1:n
```

```
yest=yest+x^i/factorial(i)


end
plot(x,y,"r")
plot(x,yest)
error=abs(y-yest)

disp(error)
```

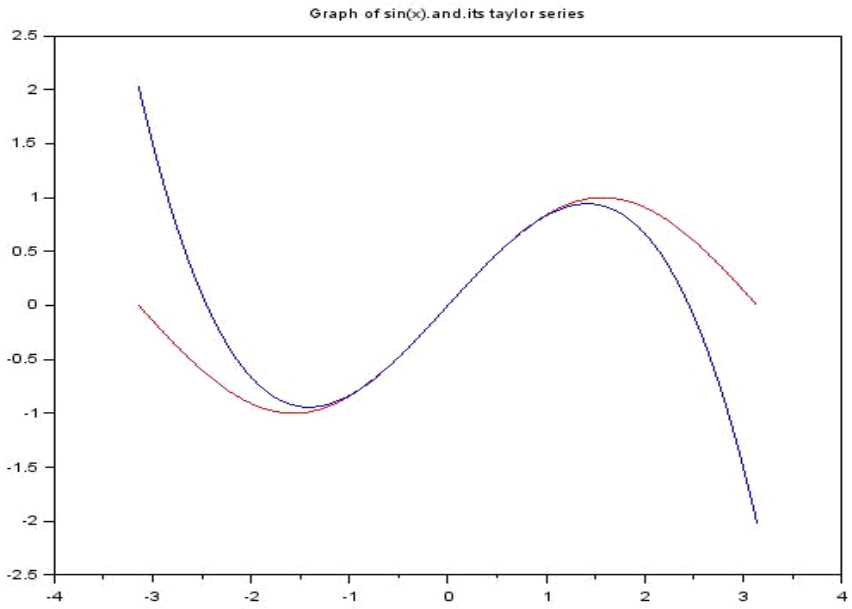
Output:


24 000
22 000
20 000
18 000
16 000
14 000
12 000
10 000
8 000
6 000
4 000
2 000
0
-10
-8
-6
-4
-2
0
2
4
6
8
10

5.2.2] Input:

```
clc;
clear;
x=linspace(-%pi,%pi,100)
y=sin(x)
yest=0
n=1
for i=0:1:n
yest=yest+((-1)^i)*(x^(2*i+1)/factorial(2*i+1))

end
plot(x,y,"r")
plot(x,yest)
xtitle("Graph of sin(x).and.itstaylor series")
error=abs(y-yest)
disp(error)
```

Output :


Graph of sin(x).and.its taylor series
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-4
-3
-2
-1
0
1
2
3
4

Experiment-6

Write a SCILAB -CODE for Fourier Half Range series expansion of different wave forms and comparison with the original function.

Objectives:

To write a script file

6.1. To find the **Fourier half range cosine series** of f(x) in Half-range (0, L) .

6.2. To find the **Fourier half range sine series** of f(x) in Half-range (0, L) .

6.3. To find the **Fourier series** of f(x) in (-L, L) .

Exercises: (All exercises to be solved on scinotes)

6.1.1. To find the ***Fourier*** **coefficients**of the **Half range cosine series** of $y=f(x)= x^2$ in (0,2) and

compare the graph of the function and the series.

6.1.2. To find the **Fourier coefficients**of the **Half range sine series** of $y=f(x)= x^2$ in (0,2) and **compare the graph** of the function and the series.

6.2.1. To find the ***Fourier* coefficients**of the **Half range cosine series** of

$y=f(x)= x$ in (0, pi) and **compare the graph** of the function and the series.

6.2.2. To find the ***Fourier* coefficients**of the **Half range sine series** of y=f(x)= xin (0, pi) and **compare the graph** of the function and the series.

6.3.1. To find the ***Fourier* coefficients**of the **Fourier series** of $y=f(x)= x^2$ in (0, 2pi) and **compare the graph** of the function and the series.

SOLUTIONS

6.1.1

Source Code

```
clc
clear
clf
L=input("Enput the value of L=")
n=input("Enter the valu of n=")
//to find fourircoff  a0 n an
a0=(2/L)*integrate('x^2','x',0,L)
disp("a0",a0)
fori=1:n
a(1)=(2/L)*integrate('x^2*cos((i*%pi*x)/L)','x',0,L)
end
disp("a",a)
//comparing the graph of funtion and its cosine series
x=linspace(0,L,40)
y=x^2
```

```
series=a0/2
fori=1:n
series=series+a(i)*cos(i*%pi*x/L)
end
plot(x,y)
plot(x,series,"*r")
xtitle("plot   function vs its fourier series by Satyam Shrivastav ","x-axis","y-axis")
legend("plot of function","plot of funtion by fourier series")
```

Output

Enput the value of L=2

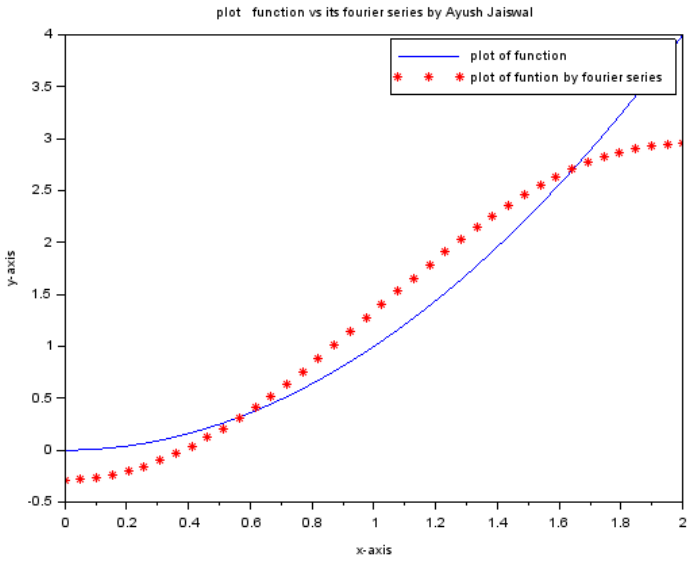
Enter the valu of n=1

"a0"

2.6666667

"a"

-1.6211389



6.1.2

Source Code

clc

clear

clf

```
L=input("Enput the value of L=")
n=input("Enter the valu of n=")
//to find fourircoff  bn
fori=1:n
b(i)=(2/L)*integrate('x^2*sin(i*%pi*x/L)','x',0,L)
end
disp("b",b)
//comparing the graph of funtion and its sine series
x=linspace(0,L,40)
y=x^2
series=0
fori=1:n
series=series+b(i)*sin(i*%pi*x/L)
end
plot(x,y)
plot(x,series,"*r")
xtitle("plot   function vs its fourier series by Satyam Shrivastav]","x-axis","y-axis")
```

legend("plot of function","plot of funtion by fourier series")

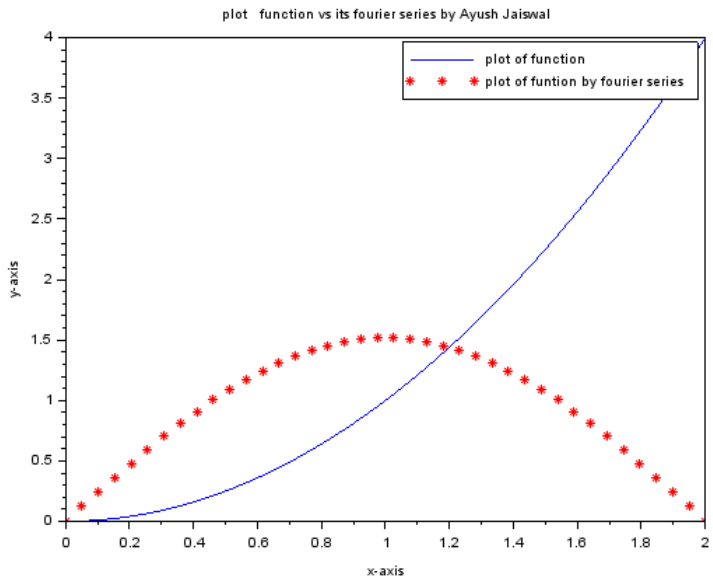
Output

Enput the value of L=2

Enter the valu of n=1

"b"

1.5144300



6.2.1

Source Code

```
clc
clear
clf
L=input("Enput the value of L=")
n=input("Enter the valu of n=")
//to find fourircoff  a0 n an
a0=(2/L)*integrate('x','x',0,L)
disp("a0",a0)
fori=1:n
a(1)=(2/L)*integrate('x*cos((i*%pi*x)/L)','x',0,L)
end
disp("a",a)
//comparing the graph of funtion and its cosine series
x=linspace(0,L,40)
y=x
series=a0/2
```

```
fori=1:n
series=series+a(i)*cos(i*%pi*x/L)
end
plot(x,y)
plot(x,series,"*r")
xtitle("plot   function vs its fourier series by Satyam Shrivastav","x-axis","y-axis")
legend("plot of function","plot of funtion by fourier series")
```

Output

Enput the value of L=%pi

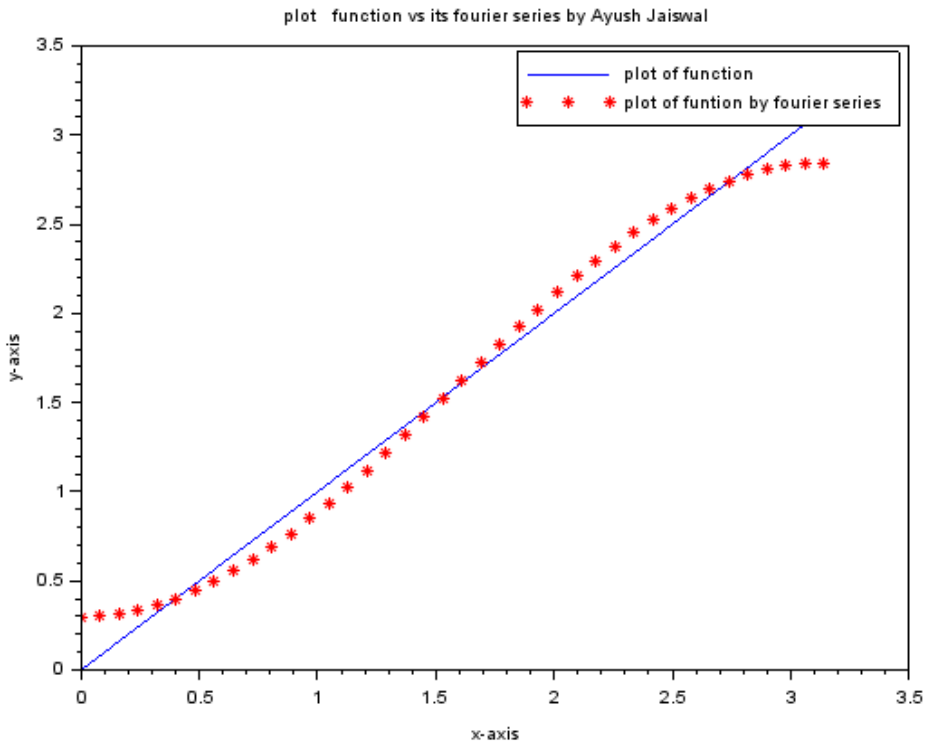
Enter the valu of n=1

"a0"

3.1415927

"a"

-1.2732395



6.2.2

Source Code

clc

clear

clf

```
L=input("Enput the value of L=")
n=input("Enter the valu of n=")
//to find fourircoff  bn
fori=1:n
b(i)=(2/L)*integrate('x*sin(i*%pi*x/L)','x',0,L)
end
disp("b",b)
//comparing the graph of funtion and its sine series
x=linspace(0,L,40)
y=x
series=0
fori=1:n
series=series+b(i)*sin(i*%pi*x/L)
end
plot(x,y)
plot(x,series,"*r")
xtitle("plot   function vs its fourier series by Satyam Shrivastav","x-axis","y-axis")
```

legend("plot of function","plot of funtion by fourier series")

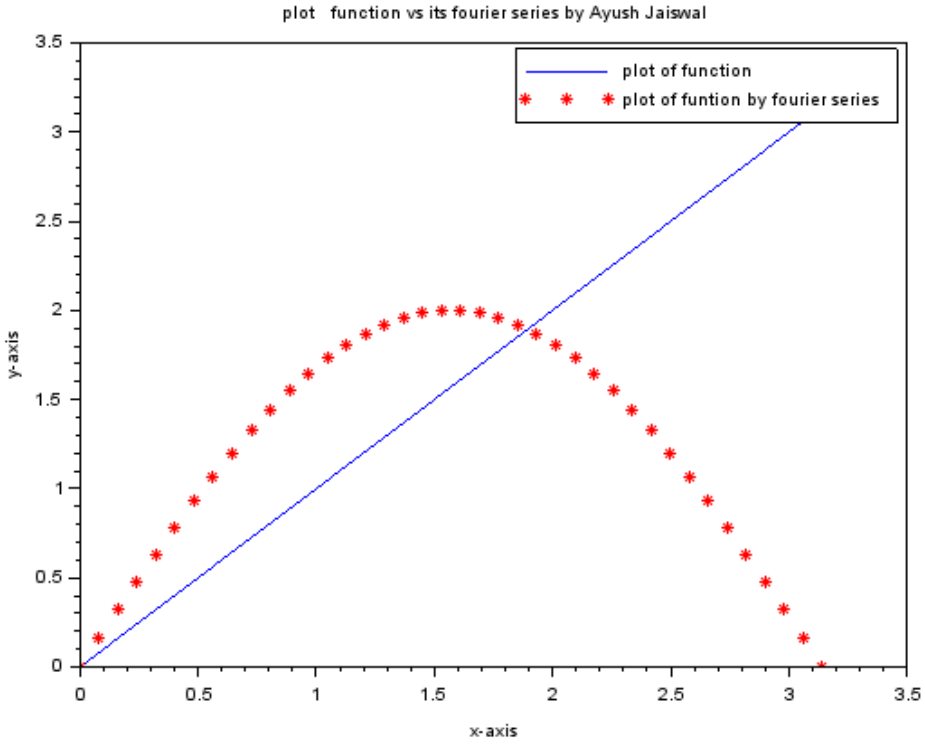
Output

Enput the value of L=%pi

Enter the valu of n=1

"b"

2.0000000



6.3.1

Source Code

```
clc
clear
clf
```

```
L=input("Enput the value of L=")
n=input("Enter the valu of n=")
//To find the Fourier  coefficients of the Fourier series of y=f(x)=  x2
a0=(2/L)*integrate('x^2','x',0,1)
fori=1:n
a(i)=(2/L)*integrate('(x^2)*cos(i*%pi*x/L)','x',0,1)
b(i)=(2/L)*integrate('(x^2)*sin(i*%pi*x/L)','x',0,1)
end
disp("a0",a0)
disp("a",a)
disp("b",b)
//comparing the graph of  the function and  the series.
x=linspace(0,2,40)
y=x^2
series=a0/2
fori=1:n
series=series+(a(i)*cos(i*%pi*x/L))
```

```
series=series+(b(i)*sin(i*%pi*x/L))
end
plot(x,y,)
plot(x,series,"*r")
xtitle("plot   function vs its fourier series by Satyam Shrivastav","x-axis","y-axis")
legend("plot of function","plot of funtion by fourier series")
```

Output

Enput the value of L=2*%pi

Enter the valu of n=1

"a0"

0.1061033

"a"

0.0982632

"b"

0.0386938