Saveetha Institute of Medical And Technical Sciences
Saveetha School of Engineering
Department of Electronics and Communication Engineering

ENGINEER TO EXCEL

Saveetha Institute of Medical And Technical Sciences
Simats School of Engineering
Department of Electronics and Communication Engineering

ENGINEER TO EXCEL

Sub Code: ECA 05	**Subject Name:** Engineering Electromagnetics	
Branch: ECE	**Year & Section: II**	**Semester: III**

Sl. No	Date	List of experiments	Page No	Signature
1.		Variable Transformation between Cartesian, Cylindrical and Spherical coordinate system to obtain the location of any object.		
2.		Determination and plotting of Electric field and Electric flux density in sphere full of charges with varying radius.		
3.		Determination and plotting of Force of attraction between two electric Charges and two parallel conductors separated by varying distance.		
4.		Analysis of Continuous Charge Distribution in electric field. To find the (i) line charge density, (ii) Surface charge density and (iii) Volume charge density for any specific (a) line, (b) surface or (c) volume.		
5.		Determination and plotting of Electric potential difference between any two points in free space medium separated by a distance R.		
6.		Determination and plotting of Capacitance of parallel plate capacitor in three different dielectric medium with specific area, dielectric thickness and various dielectric constant.		
7.		Determination and plotting of Capacitance of isolated and concentric sphere with different inner and outer radius and dielectric constant of the dielectric mediums.		
8.		Determination and plotting of Capacitance of Co-axial cable per unit length with different (i) inner radius, (ii) outer radius and (iii) relative permittivity of the dielectric medium.		
9.		Implement Dielectric free space boundary condition in Electric Field and find the relative permittivity of the different medium.		
10.		Implement Boundary condition between two different dielectric medium in Magnetic Field and find the relative permeability of the different medium.		
11.		Determination and plotting of Magnetic Flux density in Ferromagnetic Materials with different (i) length, (ii) width and (iii) magnetic field intensity.		
12.		Determination and plotting of Magnetic and Electric Field Intensity due to infinite long conductor at any specific point located at a height H.		
13.		Determination and plotting of (i) Intrinsic impedance and (ii) Phase velocity of various medium with different relative (a) permittivity and (b) permeability.		
14.		Determination and plotting of Polarization in different Dielectric Medium with their relative permittivity and to find electric susceptibility.		
15.		Determination and plotting of Inductance (i) Self-inductance and Mutual inductance of current carrying coil, (ii) solenoid and toroid with different (a) length and (b) circumferential area.		

Exp. No: 1

Date: **Transformation between Cartesian, Cylindrical and spherical coordinate system**

Aim:

To write program for Transformation between Cartesian, Cylindrical and spherical coordinate system using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

1(i).

```
clc;
x=input('Enter the value of X=');
y=input('Enter the value of y=');
z=input('Enter the value of z=');
r=sqrt(x^2+y^2);
pi=tan(y/x);
disp('Cartesian to cylindrical coordinate system of p(r,pi,z)=',[r pi z]);
r=sqrt(x^2+y^2+z^2);
theta=cos(z/r);
pi=tan(y/x);
disp('Cartesian to spherical coordinate system of s(r,theta,pi)=',[r theta pi]);
```

Output:-

```
Enter the value of X=10

Enter the value of y=15

Enter the value of z=20


 "cartesain to cylinderical coordinate system of p(r,pi,z)="

  18.027756   56.309932   20.

 "cartesain to spherical coordinate system of s(r,theta,pi)="
```

26.925824 42.031114 56.309932

1(ii).

```
clc;
r=input('Enter the value of r=');
pi=input('Enter the value of pi=');
z=input('Enter the value of z=');
x=r*cos(pi);
y=r*sin(pi);
z=z;
disp('cylindrical to cartesian coordinate system of p(x,y,z)=',[x y z]);
r=sqrt(r^2+z^2);
pi=pi;
theta=tan(r/z);
disp('cylindrical to spherical coordinate system of s(r,pi,theta)=',[r pi theta]);
```

Output:-

Enter the value of r=10

Enter the value of pi=15

Enter the value of z=20

"cylinderical to cartesian coordinate system of p(x,y,z)="

9.6592583 2.5881905 20.

"cylinderical to spherical coordinate system of s(r,pi,theta)="

22.36068 15. 48.189685

1(iii).

```
clc;
r=input('Enter the value of r=');
pi=input('Enter the value of pi=');
theta=input('Enter the value of theta=');
x=r*sin(theta)*cos(pi);
y=r*sin(theta)*sin(pi);
```

```
z=r*cos(theta);
disp('spherical to cartesian coordinate system of p(x,y,z)=',[x y z]);
p=r*sin(theta);
pi=pi;
z=r*cos(pi);
disp('spherical to cylindrical coordinate system of s(p,pi,z)=',[p pi z]);
```

Output:-

Enter the value of r=10

Enter the value of pi=15

Enter the value of theta=20

"spherical to cartesian coordinate system of p(x,y,z)="

-2.5982857 2.2241154 9.3969262

"spherical to cylinderical coordinate system of s(p,pi,z)="

9.1294525 15. -7.5968791

Result :

Thus the program was verified Transformation between Cartesian and Cylindrical coordinate system its classified two categories (a) Cartesian to cylindrical and spherical coordinate system (b) Cylindrical to cartesian and spherical coordinate system (c) spherical to cartesian and cylindrical coordinate system using SCILAB was successfully.

Exp. No: 2 Determination and plotting of Electric field and Electric flux density in sphere full of charges with varying radius.
Date:

Aim:

To write program for electric field and electric flux density in sphere using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;

q=input('Enter the value of q=');
r=input('Enter the value of r=');

efcilon=8.854*10^-12;
pi=3.14
E=q/4*pi*efcilon*r^2;
disp("The electric field is", [E]);
D=E*efcilon;
disp("The flux density is", [D]);

x = linspace(0, 10, 50);
y = E * exp(-0.1 * x);
z = D * exp(-0.1 * x);

figure();
subplot(2, 2, 1);
plot2d3(x,y);
xlabel("R");
ylabel("Electric field intensity");
title('Electric field intensity');
subplot(2, 2, 2);
plot2d3(x,z);
xlabel("A");
```

```
ylabel("Electric flux intensity");
title('Electric flux intensity');
```

Output:-

Enter the value of q=2*10^-2

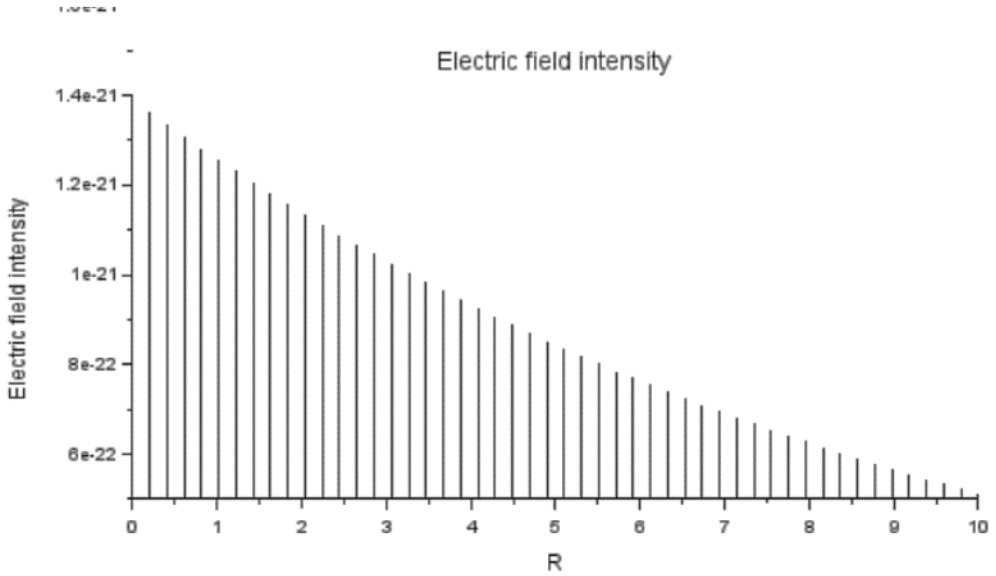
Enter the value of r=0.1*10^-3

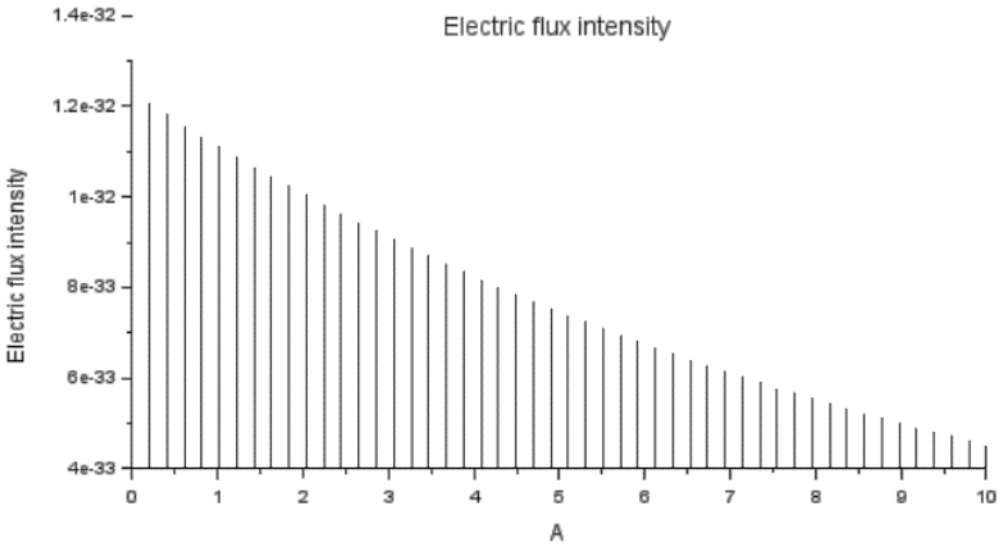
"The electric field is"

1.390D-21

"The flux density is"

1.231D-32





Result :

Thus the program was verified for electric field and electric flux density in sphere using SCILAB was successfully.

Exp. No: 3 Determination and plotting of Force of attraction between two electric Charges and two parallel conductors separated by varying distance.

Date:

Aim:

To Determination and plotting of Force of attraction between two electric Charges and two parallel conductors separated by varying distance between them using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
charge_1 = input("Enter the charge_1 value=");
charge_2 = input("Enter the charge_2 value=");
radius = input("Enter the radius value=");
current_1 = input("Enter the current_1 value=");
current_2 = input("Enter the current_2 value=");
l = input("Enter the length value=");
d = input("Enter the d value=");
mu = 4*3.14*10^-7;
efcilon=8.854*10^-12;
pi=3.14;
F=(charge_1 * charge_2)/4*pi*efcilon*radius^2;
f=((mu*current_1*current_2*l)/2*pi*d)
disp("THE FORCE BETWEEN TWO ELECTRIC CHARGES", [F]);
disp("THE FORCE BETWEEN TWO PARALLEL CONDUCTORS", [f]);
x = linspace(0, 10, 50);
y = F * exp(-0.1 * x);
z = f * exp(-0.1 * x);
figure();
subplot(2, 2, 1);
plot2d3(x,y);
xlabel("R");
```

```
ylabel("Force");
title('FORCE BETWEEN TWO ELECTRIC CHARGES');
subplot(2, 2, 2);
plot2d3(x,z);
xlabel("D");
ylabel("Force");
title('FORCE BETWEEN TWO PARALLEL CONDUCTORS');
```

Output:-

Enter the charge_1 value=1

Enter the charge_2 value=2

Enter the radius value=3*10^2

Enter the current_1 value=3

Enter the current_2 value=4

Enter the length value=5

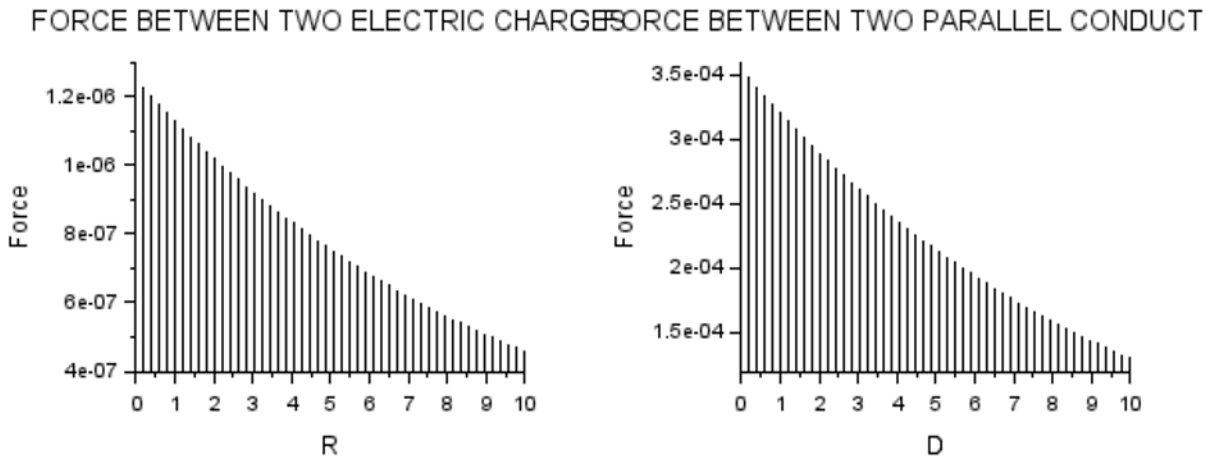
Enter the d value=3

"THE FORCE BETWEEN TWO ELECTRIC CHARGES"

0.0000013

"THE FORCE BETWEEN TWO PARALLEL CONDUCTORS"

0.0003549



Result : Thus the program was verified for the force of attraction or repulsion acting along a straight line between two electric charges is directly proportional to the product of the charges and inversely to the square of the distance between them using SCILAB was successfully.

Exp. No: 4 Analysis of Continuous Charge Distribution in electric field. To find the (i) line charge density, (ii) Surface charge density and (iii) Volume charge density for any specific (a) line, (b) surface or (c) volume.

Date:

Aim: To write program for continuous Charge Distribution in electric field. The different types of charge density there are (a) Linear Charge Density, (b) Surface Charge Density, (c) Volume Charge Density using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
q=input("Enter the charge value is:");
l=input("Enter the length value is:");
//line charge density
rl=(q/l);
disp('the line charge density is',[rl]);
//surface charge density
pi=3.14;
r=input("Enter the radius value is:");
rs=q/(4*pi*r^2);
disp('the surface charge density is',[rs]);
//volume charge density
rv=q/(1.33*pi*r^3);
disp('the volume charge density is',[rv]);
x = linspace(0, 10, 50);
y = rl*exp(-0.1 * x);
z = rs*exp(-0.1 * x);
v = rv*exp(-0.1 * x);

figure();
```

```
subplot(2, 2, 1);
plot2d3(x,y);
title('the line charge density is');
xlabel("length");
ylabel("rho l");
subplot(2, 2, 2);
plot2d3(x,z);
title('the surface charge density is');
xlabel("length");
ylabel("rho s");
subplot(2,2,3);
plot2d3(x,v);
title('the volume charge density is');
xlabel("length");
ylabel("rho v");
```

Output:-

Enter the charge value is:2*10^-2

Enter the length value is:1*10^-3

"the line charge density is"

20.

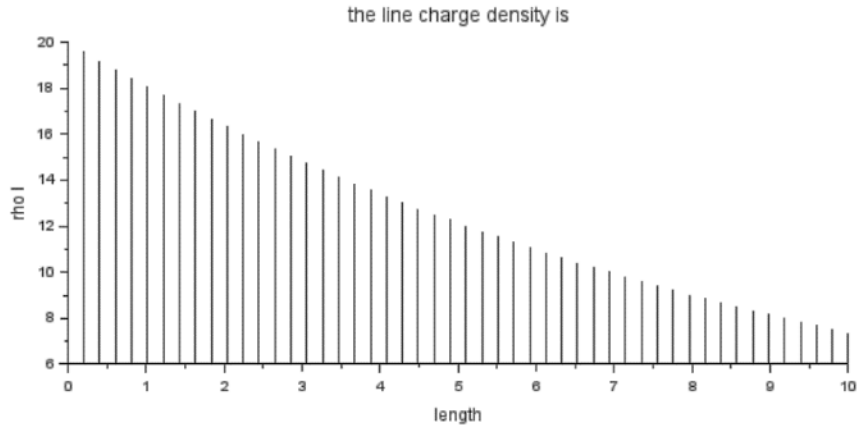
Enter the radius value is:2

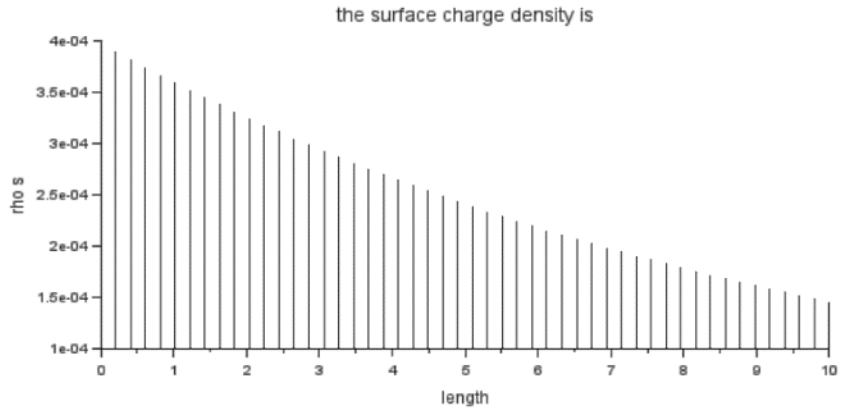
"the surface charge density is"

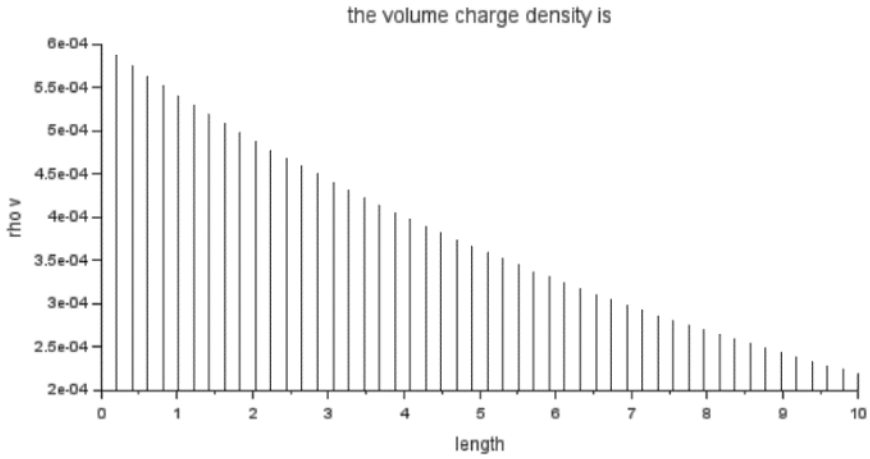
0.0003981

"the volume charge density is"

0.0005986







Result : Thus the program was verified for continuous Charge Distribution in electric field. The different types of charge density there are (a) Linear Charge Density, (b) Surface Charge Density, (c) Volume Charge Density using SCILAB was successfully.

Exp. No: 5 Determination and plotting of Electric potential difference between any two points in free space medium separated by a distance R.

Date:

Aim:

To write program for Electric potential difference between two points in free space medium using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;

clear;

q=input("Enter the q value:");
e=8.854*10^-12;
pi=3.14;

ax=input('Enter the value of ax=');
ay=input('Enter the value of ay=');
r1=sqrt(ax^2+ay^2);
v1=q/(4*pi*e*r1);
disp('The value of v1',[v1]);

bx=input('Enter the value of bx=');
by=input('Enter the value of by=');
r2=sqrt(bx^2+by^2);
v2=q/(4*pi*e*r2);
disp('The value of v2',[v2]);

r=r1-r2;
v=v1-v2;
disp('The electric potential difference is',[v]);
r1 = linspace(0, 10, 50);
r2= linspace(0, 10, 50);
r= linspace (0, 10, 50);
y = v1*exp(-0.1 * r1);
```

```
z = v2*exp(-0.1 * r2);
x = v*exp(-0.1 * r);

figure();
subplot(2, 2, 1);
plot2d3(r1,y);
xlabel("radius 1");
ylabel("voltage 1");
title('The potential difference v1');
subplot(2, 2, 2);
plot2d3(r2,z);
xlabel("radius 2");
ylabel("voltage 2");
title('The potential difference v2');
subplot(2, 2, 3);
plot2d3(r,x);
xlabel("radius");
ylabel("voltage difference");
title('The potential difference v');
```

Output:-

Enter the q value:2*10^-2

Enter the value of ax=1

Enter the value of ay=4

"The value of v1"

43619068.

Enter the value of bx=36

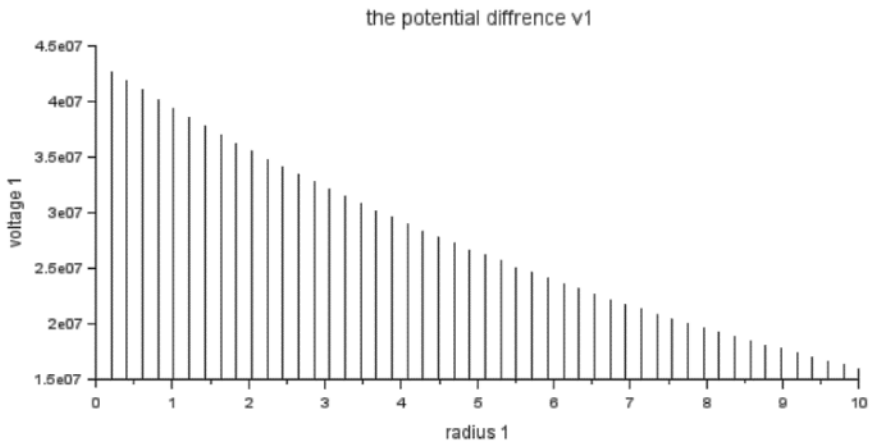
Enter the value of by=64

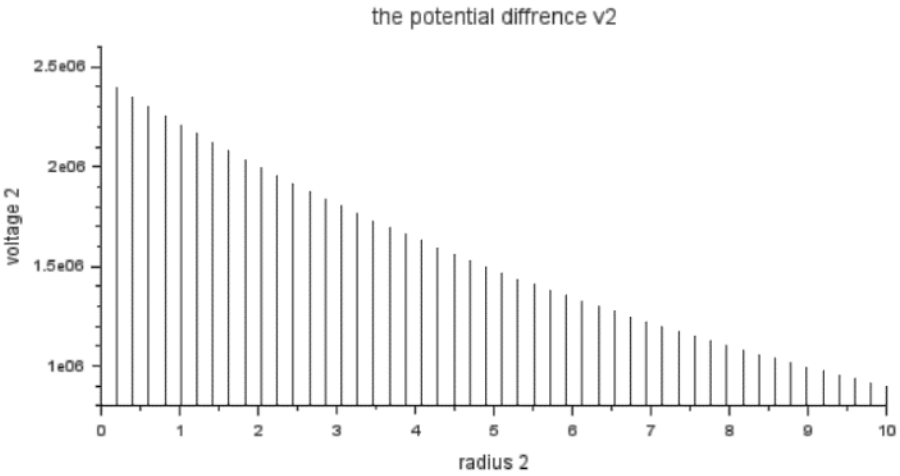
"The value of v2"

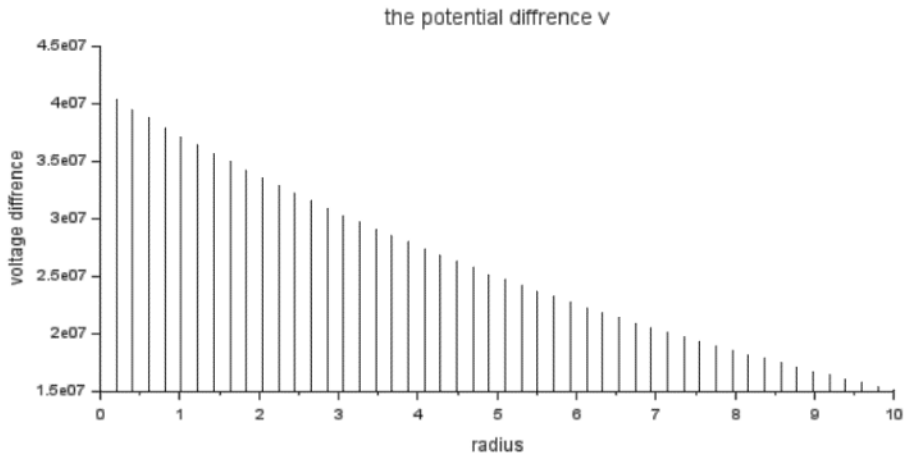
2449209.3

"The electric potential difference is"

41169858.







Result :

Thus the program was verified for Electric potential difference between two points in free space medium using SCILAB was successfully.

Exp no:6 Determination and plotting of Capacitance of parallel plate capacitor in three different dielectric medium with specific area, dielectric thickness and various dielectric constant.

Date:

Aim:

To write program for capacitance of parallel plate capacitor in three different dielectric media using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

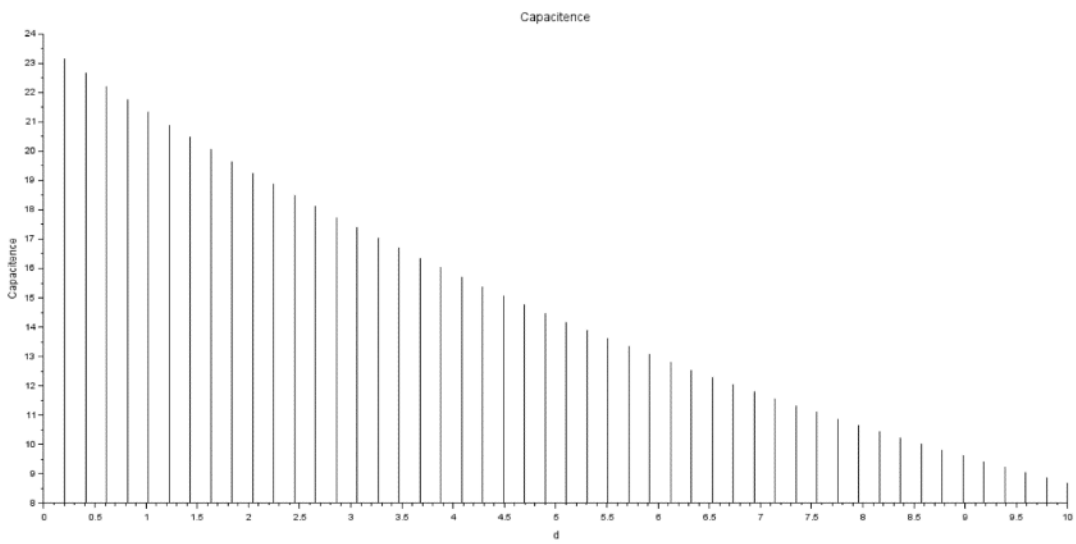
Program:

```
clc;
clear;
a1=input("Enter the a1 value is:");
d=input("Enter the d value is:");

e=8.854*10^-12;
c=e*a1/d;
disp(c);
d = linspace(0, 10, 50);
y = c * exp(-0.1 * d);

plot2d3(d,y);
xlabel("d");
ylabel("capacitance");
title("Parallel plate capacity");

a2=input("Enter the a2 value is:");
d1=input("Enter the d1 value is:");
d2=input("Enter the d2 value is:");
d3=input("Enter the d3 value is:");
er1=input("Enter the er1 value is:");
er2=input("Enter the er2 value is:");
er3=input("Enter the er13 value is:");
c1=e*a2/((d1/er1)+(d2/er2)+(d3/er3));
```

```
disp(c1);
```

Output:-

```
Enter the a1 value is:8*10^12
Enter the d value is:3

  23.610667

Enter the a2 value is:8*10^12
Enter the d1 value is:1
Enter the d2 value is:3
Enter the d3 value is:2
Enter the er1 value is:2.3

Enter the er2 value is:3.3
Enter the er13 value is:4

  38.414782
```



Result :

Thus the program was verified for capacitance of parallel plate capacitor in three different dielectric media using SCILAB was successfully.

Exp:7 - Determination and plotting of Capacitance of isolated and concentric sphere with different inner and outer radius and dielectric constant of the dielectric mediums.

Aim:

To write program for Capacitance of an isolated sphere and two concentric sphere using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

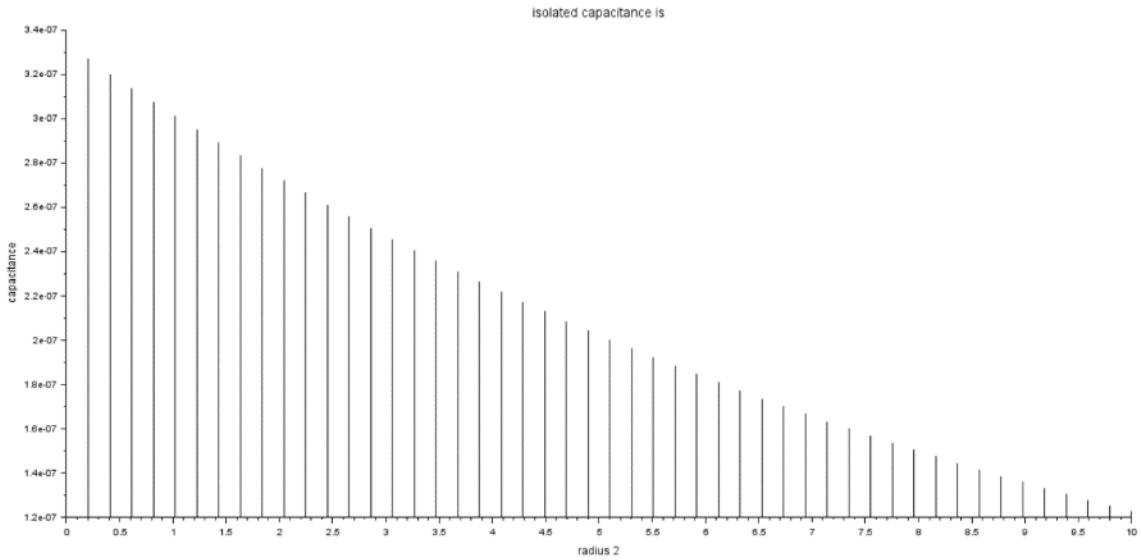
```
clc;
clear;
pi=3.14;
e=8.854*10^-12;

r1=input("Enter the r1 value is:");
r2=input("Enter the r2 value is:");
ci=4*pi*e*r2;
disp('Capacitence of isolated',[ci]);

r2=linspace(0, 10, 50);
x=ci*exp(-0.1*r2);
plot2d3(r2,x);
xlabel("raduis 2");
ylabel("capacitence");
title("isolated capcitence is");
co=(4*pi*e*(r1*r2))/(r2-r1);
disp('Capacitence of consolated',[co]);
```

Output:-

```
Enter the r1 value is:2*10^3
Enter the r2 value is:3*10^3

"Capacitence of isolated"

0.0000003
```

"Capacitence of consolated"

-5.569D-10



Result :

Thus the program was verified for Capacitance of an isolated sphere and two concentric sphere using SCILAB was successfully.

Exp no:8 - Determination and plotting of Capacitance of Co-axial cable per unit length with different (i) inner radius, (ii) outer radius and (iii) relative permittivity of the dielectric medium.

Aim:

To write program for Capacitance of co-axial cable per unit length using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
r1=input("Enter the value of radius1=");
r2=input("Enter the value of radius2=");
er=input("Enter the value of er=");

r=r2/r1;
e0=8.854*10^-12;
pi=3.14;
e=e0*er;

c=(2*pi*e)/(log(r));
disp('THE INNER AND OUTER RADIUS OF COAXIL CABLE=',[c]);

x=linspace(0, 10, 50);
y=c*exp(-0.1*x);

figure();
subplot(1, 1, 1);
plot2d3(x,y);
xlabel("R");
ylabel("Capacitance");
title("INNER AND OUTER RADIUS");
```

Output:-

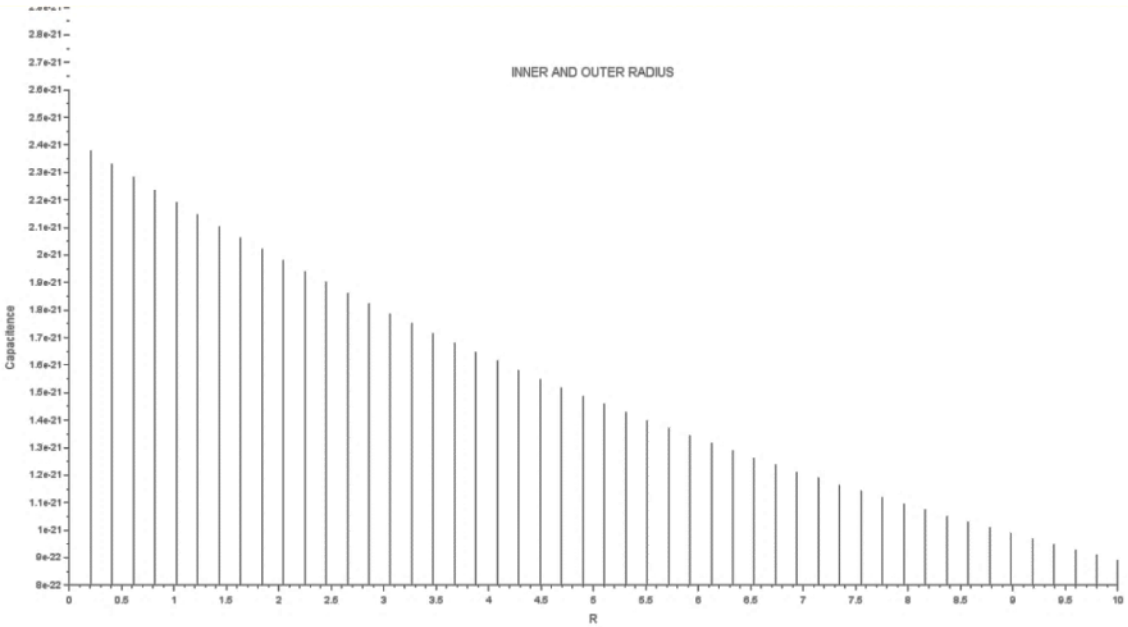
Enter the value of radius1=2*10^-2

Enter the value of radius2=3*10^-2

Enter the value of er=1.77*10^-11

"THE INNER AND OUTER RADIUS OF COAXIL CABLE="

2.427D-21



Result :

Thus the program was verified for Capacitance of co-axial cable per unit length using SCILAB was successfully.

Exp no:9 Implement Dielectric free space boundary condition in Electric Field and find the relative permittivity of the different medium.

Aim:

To write program for Dielectric - free space boundary condition in Electric field using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;

theta_1=input("Enter the value of theta1=");
theta_2=input("Enter the value of theta2=");
medium_1=input("Enter the value of er1=");

tan_theta= tand(theta_1)/tand(theta_2);
medium_2= medium_1/tan_theta;
disp('THE VALUE OF ER2 IS',[medium_2]);
```

Output:-

Enter the value of theta1=39

Enter the value of theta2=41

Enter the value of er1=2

"THE VALUE OF ER2 IS"

2.1469594

Result :

Thus the program was verified for Dielectric - free space boundary condition in Electric field using SCILAB was successfully.

Exp no:10 Implement Boundary condition between two different dielectric medium in Magnetic Field and find the relative permeability of the different medium.

Aim:

To write program for Boundary condition between two different dielectric media in magnetic field using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
theta_1=input("Enter the value of theta1=");
theta_2=input("Enter the value of theta2=");
m_1=input("Enter the value of m1=");
tan_theta= tand(theta_1)/tand(theta_2);
m_2= m_1/tan_theta;
disp('THE VALUE OF M2 IS',[m_2]);
```

Output:-

Enter the value of theta1=60

Enter the value of theta2=45

Enter the value of m1=2

"THE VALUE OF M2 IS"

1.1547005

Result :

Thus the program was verified for Boundary condition between two different dielectric media in magnetic field using SCILAB was successfully.

Exp no:11 Determination and plotting of Magnetic Flux density in Ferromagnetic Materials with different (i) length, (ii) width and (iii) magnetic field intensity.

Aim:

To write program for Magnetic flux density in ferromagnetic materials using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;

mr=input("Enter the value of mr=");
H =input("Enter the value of H=");
L =input("Enter the value of Length=");
W =input("Enter the value of Width=");

pi =3.14;
mu0=4*3.14*10^-7;
B =mu0*mr*H;
A =L*W

Flux_density = B/A;
disp('Flux density is',[Flux_density]);

x=linspace(0, 10, 50);
y=Flux_density*exp(-0.1*x);

figure();
subplot(1, 1, 1);
plot2d3(x,y);
xlabel("Area");
ylabel("Flux density");
title("Magnetic flux desity");
```

Output:-

Enter the value of mr=1*10^-7

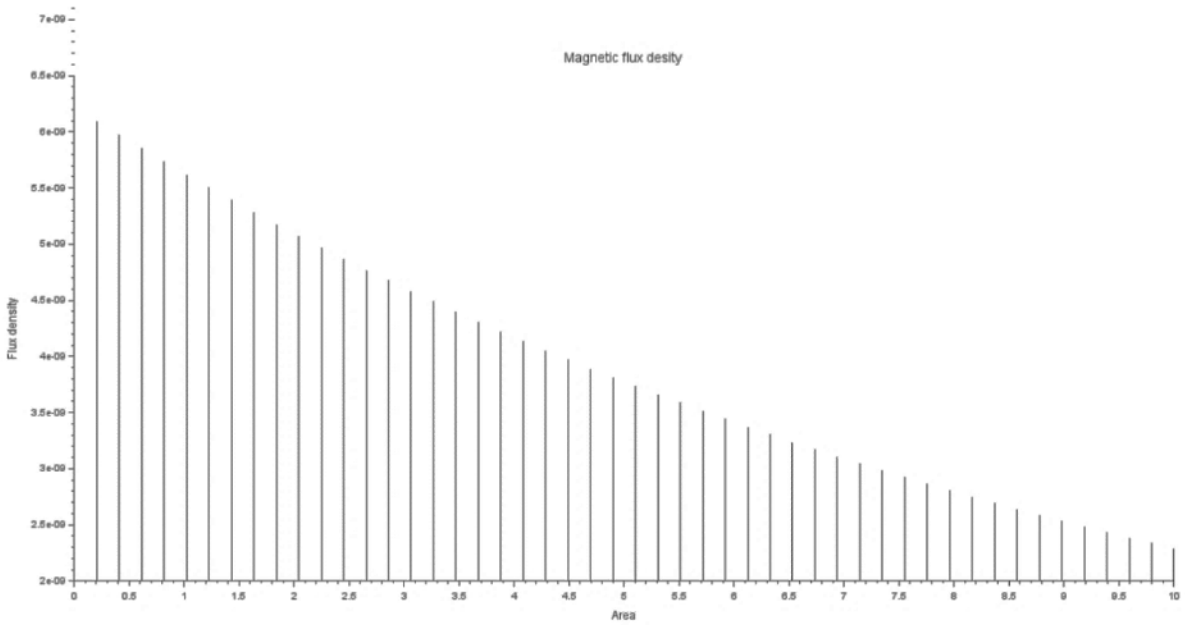
Enter the value of H=4.95*10^4

Enter the value of Length=1*10^-2

Enter the value of Width=1*10^2

"Flux density is"

6.217D-09



Result : Thus the program was verified for program for Magnetic flux density in ferromagnetic materials using SCILAB was successfully.

Exp No: 12 DETERMINATION AND PLOTTING OF MAGNETIC AND ELECTRIC FIELD INTENSITY DUE TO INFINITE LONG CONDUCTOR AT ANY SPECIFIC POINT LOCATED AT H

Date:

Aim:

To write program for Magnetic field intensity of infinite long conductor using SCILAB.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
i=input("Enter i value:");
r=input("Enter r value:");
h=i/(2*3.14*r);
disp(("Magnetic field"),[h]);
lambda=input("Enter lambda value:");
r=input("Enter r value:");
Eo=8.854*10^-12;
e=(lambda)/(2*3.14*Eo*z);
disp(("Electric field"),[e]);
figure();
x=linspace(0,10,50);
y=h*exp(-0.1*x);
z=e*exp(-0.1*x);
subplot(2,2,1);
plot2d3(x,y);
title("Magnetic field intensity");
xlabel("Radius R");
```

```
ylabel("Magnetic field intensity H");
subplot(2,2,2);
plot2d3(x,z);
title("Electric field intensity");
xlabel("Radius R");
ylabel("Electric field intensity");
```

Output:-

Enter i value:10

Enter r value:5

"Magnetic field"

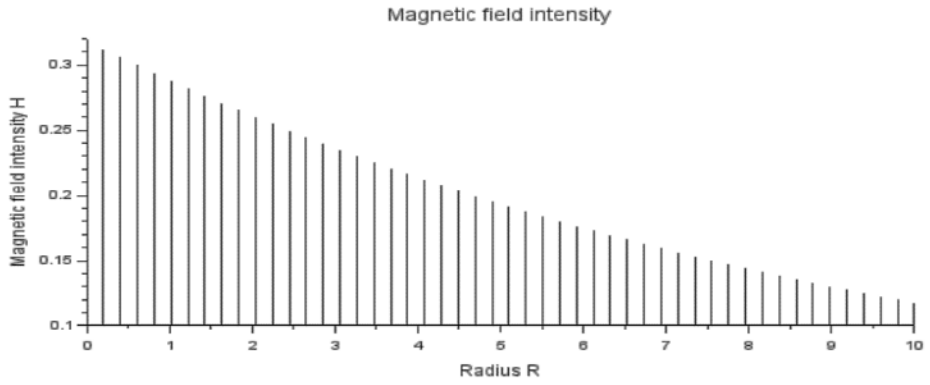
0.3184713

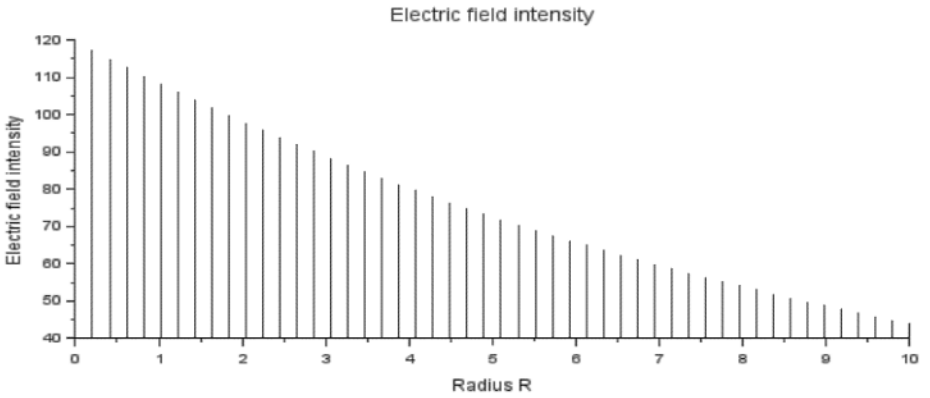
Enter lambda value:2*10^-8

Enter z value:3

"Electric field"

119.89735


Magnetic field intensity
Magnetic field intensity H
0.3
0.25
0.2
0.15
0.1
0
1
2
3
4
5
6
7
8
9
10
Radius R


Electric field intensity
Electric field intensity
120
110
100
90
80
70
60
50
40
0
1
2
3
4
5
6
7
8
9
10
Radius R

Result:

Exp no : 13 DETERMINATION AND PLOTTING OF INTINSIC IMPEDANCE AND PHASE VELOCITY OF VARIOUS MEDIUM

Date:

Aim:

To determine and plot intrinsic impedance and phase velocity of various medium.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
ur=input("Enter μr value:");
er=input("Enter εr value:");

uo=4*3.14*10^-7;
eo=8.854*10^-12;
n=sqrt(uo*ur/er*eo);
disp(("Intrinsic impedence:"),[n]);
pv=1/sqrt(uo*ur*er*eo);
disp(("Phase velocity:"),[pv]);
figure();
x=linspace(0, 10, 50);
y=n*exp(0.1*x);
z=pv*exp(-0.1*x);
```

```
subplot(2, 2, 1);
plot2d3(x,y);
title("Intrinsic impedence");
xlabel("u/E");
ylabel("Intrinsic impedence");
subplot(2, 2, 2);
plot2d3(x,z);
title("Phase velocity");
xlabel("1/sq(uE)");
ylabel("Phase velocity");
```

Output:-

Enter μr value:5

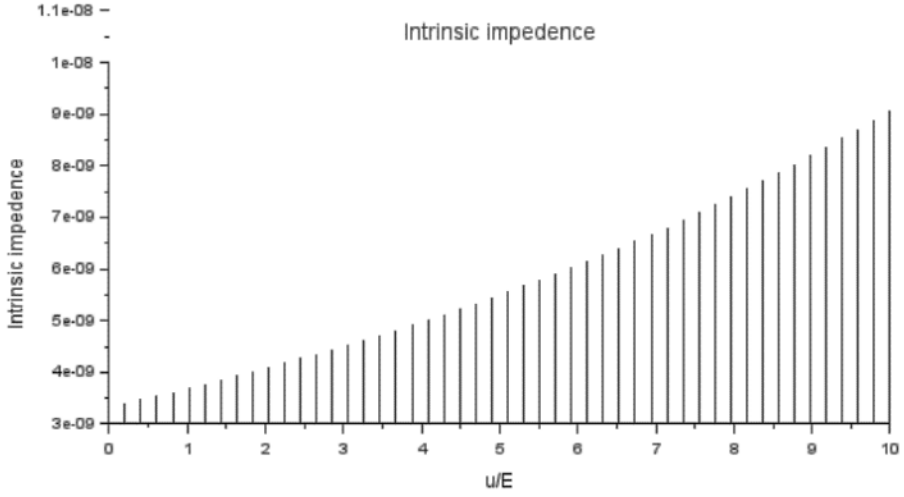
Enter εr value:5

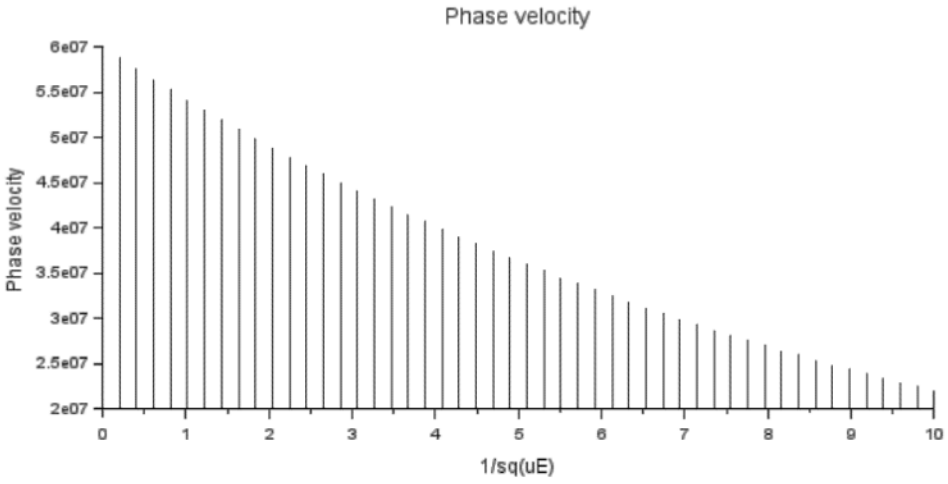
"Intrinsic impedence:"

3.335D-09

"Phase velocity:

59974332.





Result:
Thus the determination and plotting of intrinsic and phase velocity is performed and successfully verified.

Exp No: 14 : Determination and plotting of Polarization in different Dielectric Medium with their relative permittivity and to find electric susceptibility.

Date:

Aim:

To determine and plot polarization in different dielectric medium with their relative permittivity and to find electric susceptibility.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;

epsilon = 8.854*10^-12;
er = input("Enter the εr value");;
field = input("Enter the Electric Field");
chi = er - 1;
polarization = chi*epsilon*field;

disp([chi polarization]);

x = linspace(0,10,50);
y = chi*(0.1*x);
z = polarization * (0.1 * x);
```

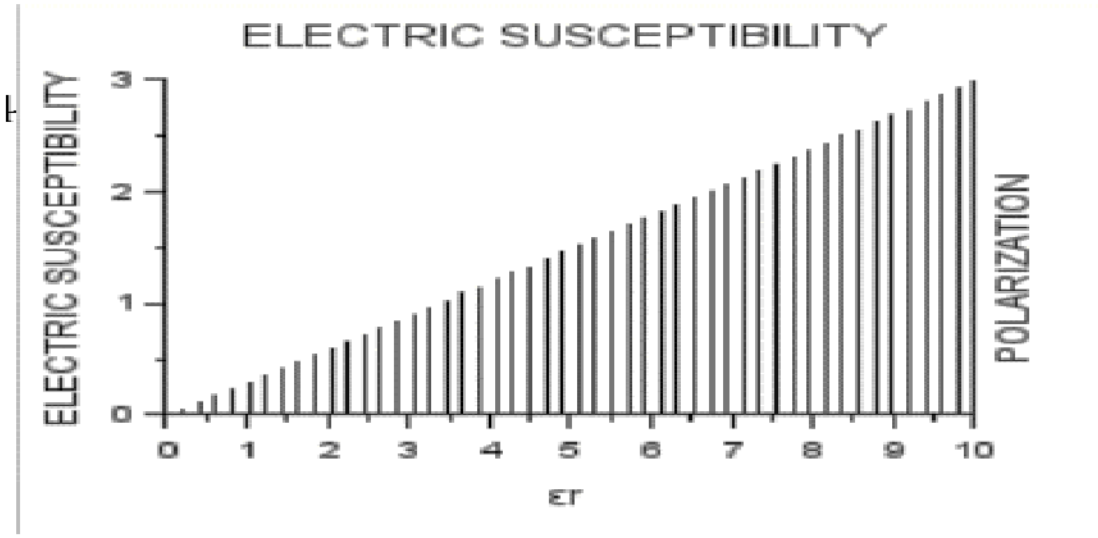
```
figure();

subplot(2,2,1);
plot2d3(x,y);
title("ELECTRIC SUSCEPTIBILITY");
ylabel("ELECTRIC SUSCEPTIBILITY");
xlabel("εr")
subplot(2,2,2);
title("POLARIZATION");
xlabel("ELECTRIC FIELD");
ylabel("POLARIZATION");
plot2d3(x,z)
```

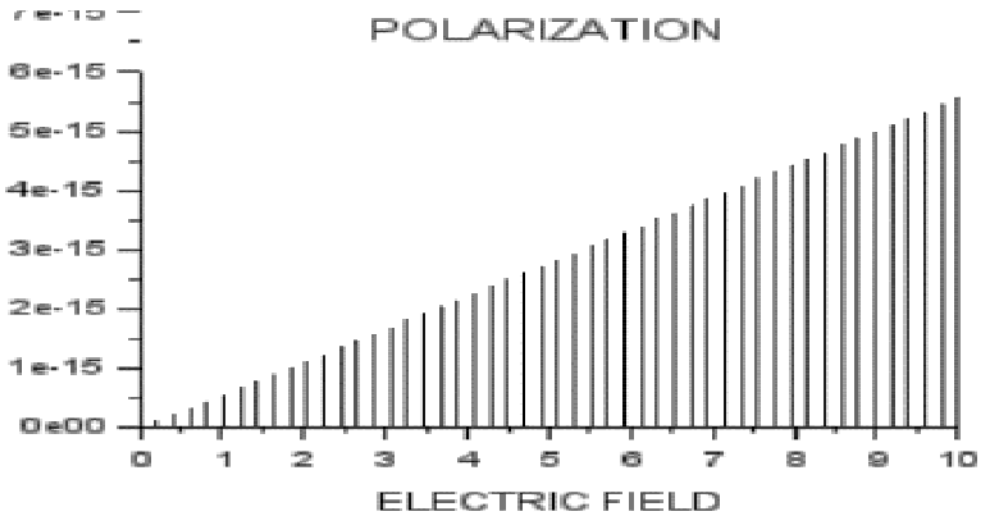
OUTPUT:

Enter the εr value4

Enter the Electric Field2.1*10^-4

3. 5.578D-15





Result:

Thus determination and plotting of Polarization in different Dielectric Medium with their relative permittivity and electric susceptibility has been performed and verified successfully.

Exp No:15 Determination and plotting of Inductance (i) Self-inductance and Mutual inductance of current carrying coil, (ii) solenoid and toroid with different (a) length and (b) circumferential area.

Date:

Aim:

To determine and plot Inductance (i) Self-inductance and Mutual inductance of current carrying coil, (ii) solenoid and toroid with different (a) length and (b) circumferential area.

Software required:

- SCILAB version 6.0.1

Theory:

Program:

```
clc;
clear;
n=input("Enter the turns of self inductance:");
phi=input("Enter the phi value:");
i=input("Enter the current flowing in inductance:");
L=n*phi/i;
disp(("Self inductance:"),[L]);
n1=input("Enter the primary turn:");
n2=input("Enter the secondary turn:");
O12=input("Enter the ϕ12:");
O21=input("Enter the ϕ21:");
i1=input("Enter the CURRENT 1:");
i2=input("Enter the CURRENT 2:");
M12=n2*O12/i1;
M21=n1*O21/i2;
```

```
disp(("Mutual inductance M12:"),[M12]);
disp(("Mutual inductance M21:"),[M21]);
LENGTH = input("Enter the length value is:");
Radius = input("Enter the radius value is:");
solenoid = 4*3.14*10^-7*i/LENGTH;
toroid = 4*3.14*10^-7*i/2*3.14*Radius;
disp([solenoid]);
disp([toroid]);

a=linspace(0,10,50);
b=L*exp(-0.1*a);
c=M12*exp(-0.1*a);
d=M21*exp(-0.1*a);
e=solenoid*exp(0.1*a);
f=toroid*exp(0.1*a);
figure();
subplot(2,2,1);
plot2d3(a,b);
xlabel("SELF INDUCTANCE");
ylabel("CURRENT");
title("SELF INDUCTANCE");
subplot(2,2,2);
plot2d3(a,c);
xlabel("MUTUAL INDUCTANCE M12");
ylabel("CURRENT 1");
title("MUTUAL INDUCTANCE M12");
subplot(2,2,3);
xlabel("MUTUAL INDUCTANCE M21");
ylabel("CURRENT 2");
plot2d3(a,d);
title("MUTUAL INDUCTANCE M21");
figure();
subplot(2,2,4);
xlabel("SOLENOID");
```

```
ylabel("CURRENT");
plot2d3(a,e);
title("INDUCTANCE OF SOLENOID");
figure();
subplot(2,2,2);
xlabel("TOROID");
ylabel("CURRENT");
plot2d3(a,f);
title("INDUCTANCE OF TOROID");
```

OUTPUT:

Enter the turns of self inductance:20

Enter the phi value:3.14*10^-3

Enter the current flowing in inductance:2.45*10^-3

"Self inductance:"

25.632653

Enter the primary turn:200

Enter the secondary turn:400

Enter the ϕ12:2.4*10^-3

Enter the ϕ21:1.45*10^-5

Enter the CURRENT 1:45*10^-2

Enter the CURRENT 2:34*10^-3

"Mutual inductance M12:"

2.1333333

"Mutual inductance M21:"

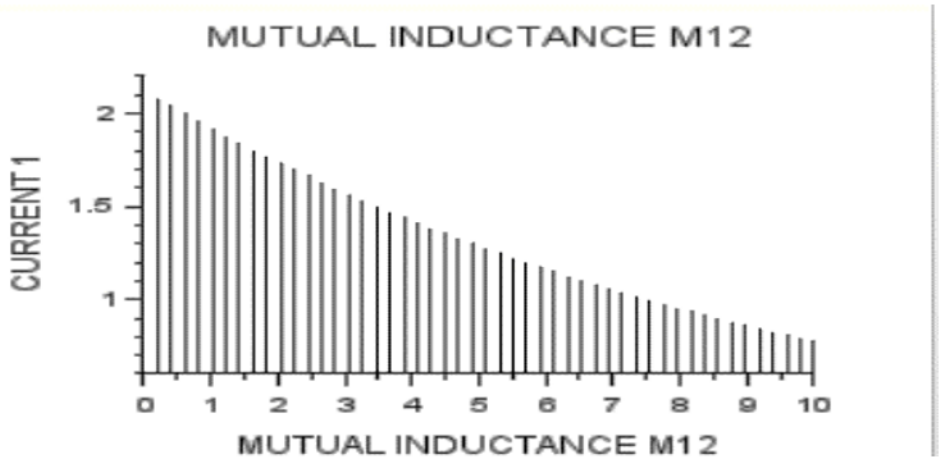
0.0852941

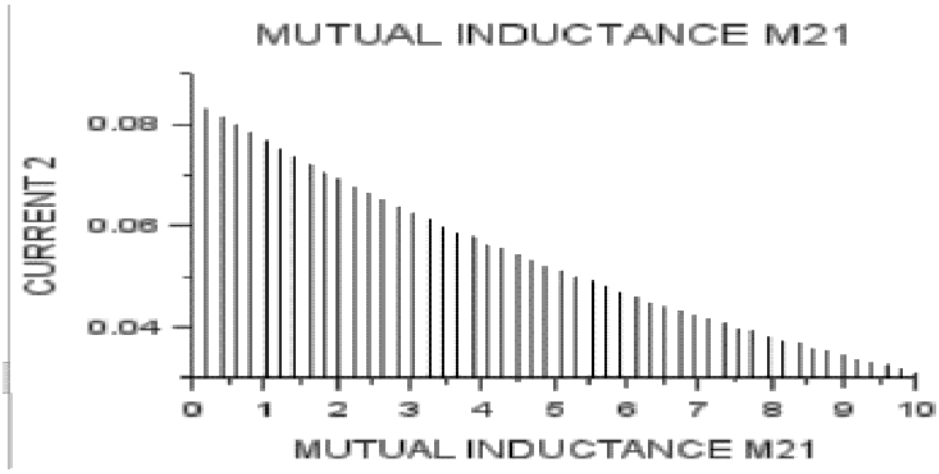
Enter the length value is:2

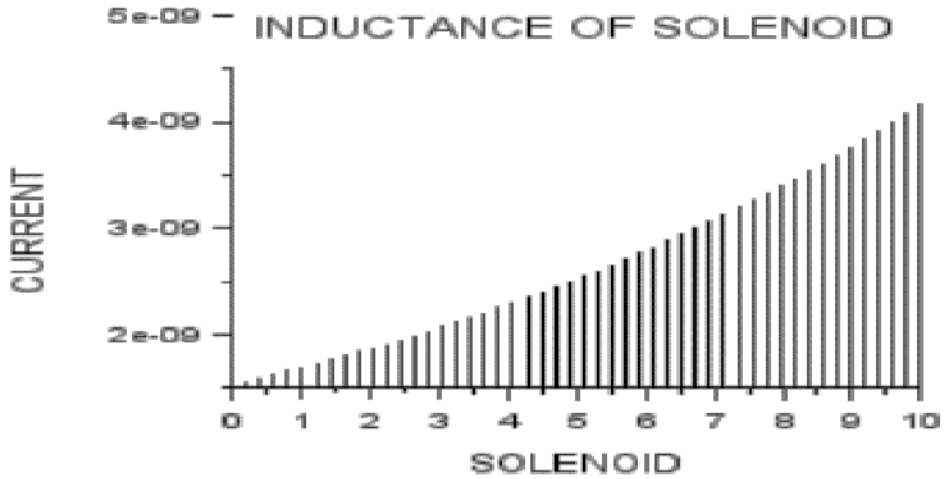
Enter the radius value is:4

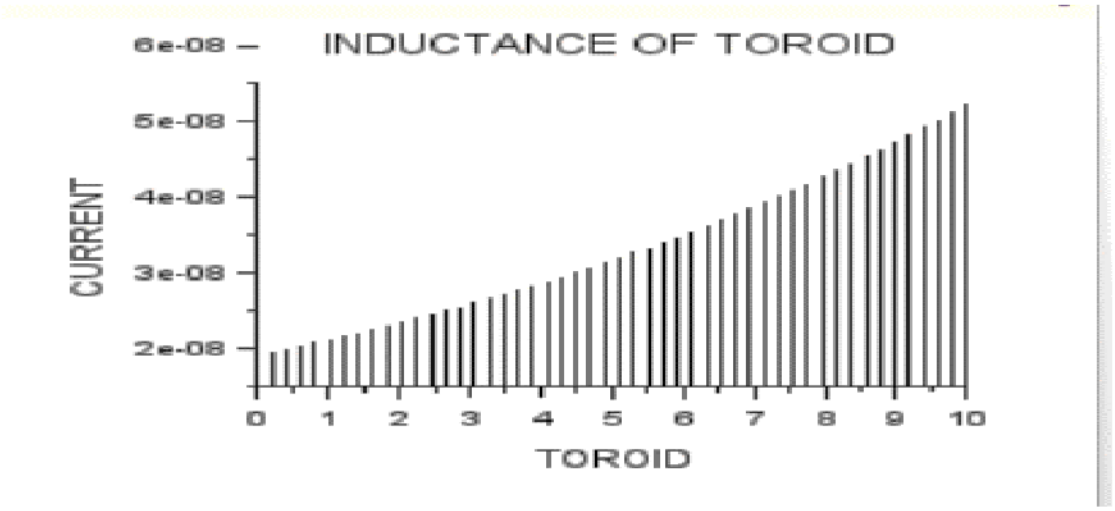
1.539D-09

1.932D-08


MUTUAL INDUCTANCE M12
CURRENT 1
2
1.5
1
0 1 2 3 4 5 6 7 8 9 10
MUTUAL INDUCTANCE M12


MUTUAL INDUCTANCE M21
CURRENT 2
0.08
0.06
0.04
0 1 2 3 4 5 6 7 8 9 10
MUTUAL INDUCTANCE M21


INDUCTANCE OF SOLENOID
CURRENT
5e-09
4e-09
3e-09
2e-09
0 1 2 3 4 5 6 7 8 9 10
SOLENOID



Result:

Thus, determination and plotting of Inductance, Self-inductance, Mutual inductance of current carrying coil, solenoid and toroid with different (a) length and (b) circumferential area are performed and verified successfully.