Experiment : 5

Name : Vishal Anand
Roll Code : 19/367
Subject : Electromagnetics
Course : B.Sc. Hons. Electronics
Semester : 5th

Experiment : 5

Aim : To plot Electric field and Electric Potential due to charge distributions.

Apparatus Required : A desktop with Scilab installed in it.

Theory :

The electric field intensity due to each of the charge distributions pL, ps, and pv may be regarded as the summation of the field contributed by the numerous point charges making up the charge distribution.

Electric field due to a point charge Q is :

$$\mathbf{E} = \frac{Q}{4\pi\varepsilon_0 R^2}\mathbf{a}_R = \frac{Q(\mathbf{r} - \mathbf{r}')}{4\pi\varepsilon_0|\mathbf{r} - \mathbf{r}'|^3}$$

Electric field due to line charge Q is :

$$\mathbf{D} = \frac{\rho_L}{2\pi\rho}\mathbf{a}_\rho$$

Electric field due to charged sphere :

$$\mathbf{D} = \begin{cases} \frac{r}{3}\rho_v \mathbf{a}_r & 0 < r \leq a \\ \frac{a^3}{3r^2}\rho_v \mathbf{a}_r & r \geq a \end{cases}$$

The potential at any point is the potential difference between that point and a chosen point in which the potential is zero.

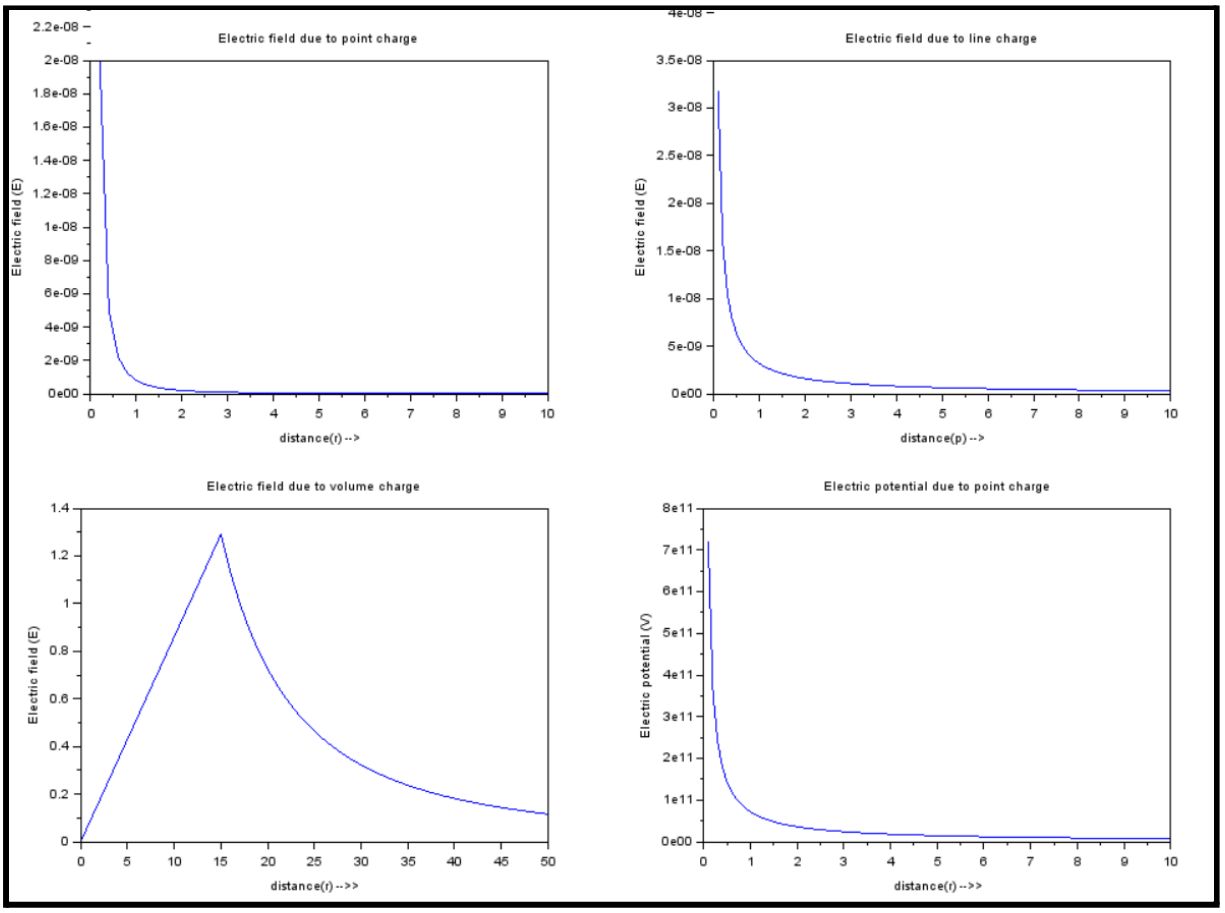
$$V = \frac{Q}{4\pi\varepsilon_0 r}$$

Code :

Expt-5-Electric field and Electric Potential-Vishal-Anand.sce

```
clc;

//Electric field due to point charge
r=0:0.2:10;
Q=10*10^-9;
E=Q*((4*%pi*r^2)^-1);
subplot(221);
plot(r,E);
title('Electric field due to point charge');
xlabel('distance(r) -->');
ylabel('Electric field (E)');

//Electric field due to line charge
p=0:0.1:10;
e0=8.854*10^-12;
pL=20*10^-9;
EL=pL*((2*%pi*p)^-1);
subplot(222);
plot(p,EL);
title('Electric field due to line charge');
xlabel('distance(p) -->');
ylabel('Electric field (E)');

//Electric field due to volume charge
//when 0<r<=a
r1=0:0.1:15;
a=15;
p0=0.258;
EV1=(r1*p0)/3;
subplot(223);
plot(r1,EV1);

//when r>=a
r2=15:50;
EV2=(a^3)*p0*((3*r2^2)^-1);
plot(r2,EV2);
title('Electric field due to volume charge');
xlabel('distance(r) -->>');
ylabel('Electric field (E)');

//Electric potential due to point charge
r=0:0.1:10;
Q=8;
V=Q*((4*%pi*e0*r)^-1);
subplot(224);
plot(r,V);
title('Electric potential due to point charge');
xlabel('distance(r) -->>');
ylabel('Electric potential (V)');
```

Output :



Result : Electric field and Electric Potential due to charge distributions have been plotted successfully using scilab software and results obtained are verified.