Lecture - 24.

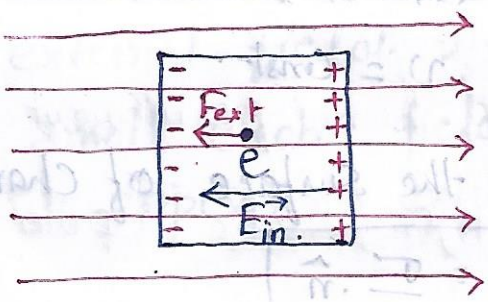
* Electrostatics of Conductor :→

In metalic conducter the charge carriers are electron. In metal the outer (valence) electrons part away from their atom's and free to move. These electron are free within the metal not free from surface of metal.

In case of electrolytic conductors, the charge carriers are both positive and negative ions but the situation in this case is more involved - the movement of the charge carriers is affected both by the external field as also by the so called Chemical force.

There are following more points important regarding Electrostatic Conducter :→

1.) Inside a conductor, electrostatic field is zero

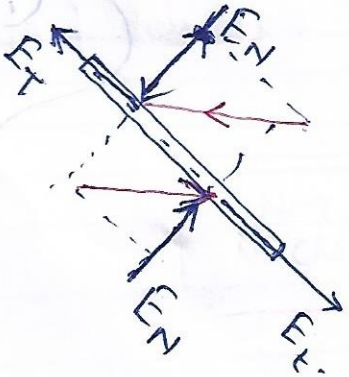


$$\vec{E}_{ext} = -\vec{E}_{in}$$

$$\vec{E}_{ext} + \vec{E}_{in} = 0$$

$$\boxed{\vec{E}_{net} = 0}$$

2.) At the surface of charged conductor electrostatic field must be normal to the surface every point.



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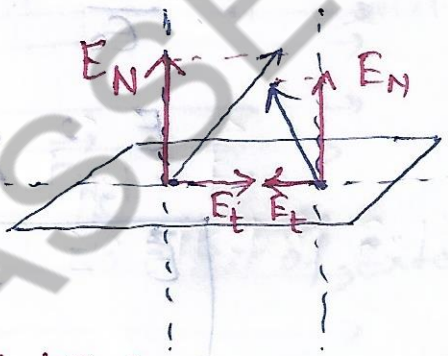
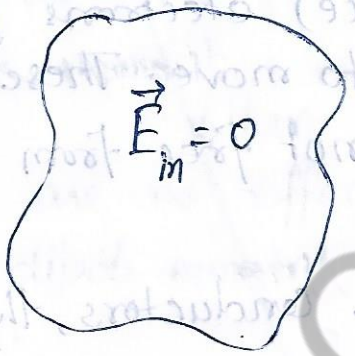


$$\text{Net}\,(E_t)_{\text{tangential}} = 0$$

$$\text{Net}\,(E_N)_{\text{Normal}} \neq 0 \perp \text{Surface.}$$

3.) The interior of a conducter can have no excess charge in static situation.

Proof:-



If $\vec{E}_{in} = 0$

$$\Phi = \vec{E}_{in} \cdot \vec{\Delta s}$$

$$\Phi = 0$$

$$\frac{q_{net}}{\epsilon_0} = 0$$

Interior charge $\boxed{q_{net} = 0}$

4.) Electrostatic potential is constant through out the volume of the conducter and has the same value (as inside) on its surface.

Proof:-

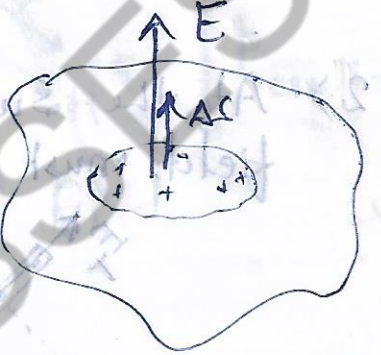
$$E_{in} = 0$$

$$-\frac{dv}{dr} = 0$$

$$v = \text{Const.}$$

5.) Electric field at the surface of charge conducter.

$$\boxed{\vec{E} = \frac{\sigma}{\epsilon_0}\hat{n}}$$



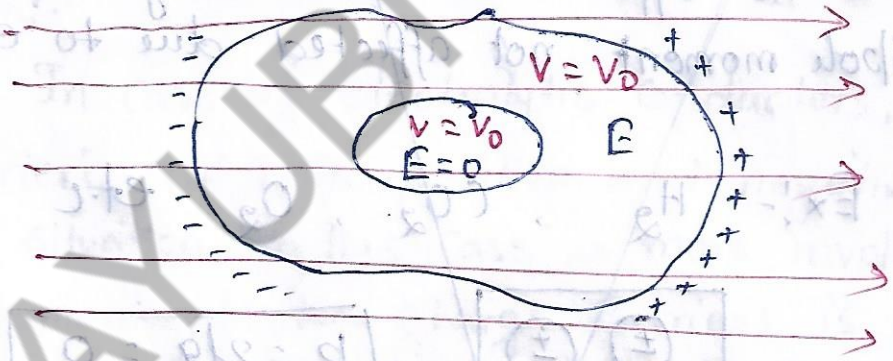
Proof:- $\phi = \vec{E} \cdot \vec{\Delta S} = E \Delta S$

$$\frac{q}{\epsilon_0} = E \Delta S$$

$$E = \frac{q}{\Delta S \epsilon_0}$$

$$\boxed{\vec{E} = \frac{\sigma}{\epsilon_0}\hat{n}}$$

6.) Electrostatic Shielding:→ The net field inside a Cavity of a Conductor is zero still the external field is maximum. But potential inside this Cavity is Constant. known as Electrostatic shielding.



* Dielectrics and Polarization

* **Dielectric** :→ It is a non-Conducting substance having very less number of charge carriers. i.e ordinary Case it behave like non-conductor but when it Keep into external field. then due to small charge Carriers a small electric field induced inside the material and opposes to external field.