Chapter #1

The Magnetic Field Of Steady Currents.

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Magnetism:-

The magnetic field of steady currents is known as magnetism.

Relation b/w E.F and M.F:-

Electric and magnetic field are perpendicular to Each other.

Induction: (Meaning)

Induction means to induce some thing from near by thing.

Columb force:-

It stated that

"The magnitute of the Electrostatic force of intereaction between two point charge is directly proportional to the scalar multiplication of the magnitudes of the charges & inversly proportional to the square of the distance between them.

$F_e = \frac{1}{}$

Keypoint:-
=> we use permitivity in Electric Field.
=> we use permiability in Magnetic Field.

Magnetic force:-
The power that pulls materials together. [Attraction or repulsion that arises bw electrically charged particles bcz of their motion.

$$F_m = \frac{\mu_0}{4\pi} \frac{qq_1}{r^2} \vec{v}\vec{v}_1 \times \left(\frac{\vec{v}_1 \times \vec{r}}{|r|} \right)$$

Where 'v' is velocity of q $\frac{\mu_0}{4\pi} = 10^{-7}\ N.S^2/C^2$
While 'v_1' is velocity of q_1

Lorentz Force:-
The combination of Electric & Magnetic force on a point charge due to Electric Magnetic fields. If a particle of charge 'q' moves with velocity 'v' in the presence of an Electric field 'E' and a Magnetic field 'B'. Then it will experiences a force known as Lorentz force.

$$F_m = q\vec{v} \times \vec{B}$$

$$F = F_e + F_m$$

$$F = q\vec{E} + q\vec{v} \times \vec{B}$$

$$F = q(\vec{E} + \vec{v} \times \vec{B})$$

Magnetic Induction:-

Also known as magnet flux. The process by which substance becomes magnetized. represented by $\vec{B}$.

Where

$$\vec{B} = \frac{\mu_0}{4\pi} \frac{q_1}{r^2} \frac{v_1 \times \vec{r}}{|r|}$$

Note Unit:- The unit of M.I is "Newton second Per Columb-meter called as Tesla. N-S/Cm

Tesla:- A unit of Magnetic Induction Equ to one Webes Per squase meter Wb/m²

Note:-

The product of free space permitivi and permiability must have the dimen sion of an inverse velocity squased.? i.e

$$\varepsilon_0 \mu_0 = \frac{1}{C^2} \quad \therefore C = 2.9979 \times 10^8 \text{ m}$$

Where 'C' is speed of light.

It may noted that Electric force is due to static Chasges. while Magnetic force is due to moving charges.

The defined value of μ_0 & Experimental value of ε_0 is finds that

$$C = 2.9979 \times 10^8 \text{ m/s}$$

The particle velocities are small as compared to the velocity of light. The magnetic interaction is very much smaller then the Electric interaction.

The field produced by the uniformly moving charge 'q' are

$$B = \frac{v_i}{c} \times \frac{E}{c}$$

The relation holds for a arbitrarily velocities, Even though 'E' and 'B' both becomes modified when 'v_i' is comparable to 'C'.

The magnetic force does not depend only on the relative velocity of the two charges, but is different in a moving coordinate system.

$$F_m << F_e$$

This shows that Magnetic force could always be neglected in comparison to the Electric one. but - there are syste of Particles where there is not so.