Electromagnetic Induction :→

Electromagnetic of magnetic Induction is the production of an electromotive (emf) force across an electric Conductor in a changing magnetic field.

Michael Faraday discovered Induction in 1831. and James Clerk Maxwell Mathematically described.

Electromagnetic Induction has many applications like as inductors and transformers and divices such as electric motors and generators.

Faraday's law -

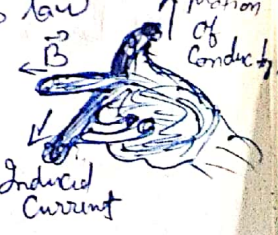
First Law (Neumann's law) When the magnetic flux through a circuit is changing, an induced emf is set up in the Circuit whose magnitude is equal to the negative rate of change of magnetic flux.

If $\Delta \Phi_B$ is change in magnetic flux in a time interval Δt, then the emf induced in the circuit is given by-

$$e = -\frac{\Delta \Phi_B}{\Delta t} \quad \text{weber/Sec or Volt} \quad \text{(1)}$$

If the Circuit is tightly wound Coil of N-turns, then the emf will be induced in each turn and the emf's of all the turns will be added up, so the induced emf in whole Coil will be- $e = -N\frac{\Delta \Phi_B}{\Delta t} = -\frac{\Delta (N \Phi_B)}{\Delta t}$ (2)

Second Law (Lenz's law) The direction of the Induced emf, or the Current, in any Circuit is such as to oppose the Cause that Produce it. This is also known as "Lenz's law." Lenz's law accordance with the Principle of Conservation of energy.



Different methods of producing e.m.f. →

1- By moving a magnet relative to the circuit.
2. By changing current in neighbouring circuit
3. By changing current in the same circuit.
4. By rotating a coil in a magnetic field.

Inductor and Induction → An inductor is a device for storing energy in a magnetic field. An inductor is generally called as inductance. Coil or solenoid is treated as inductor. Inductor may be regarded as the magnetic counterpart of a capacitor, which stores energy in an electric field.

Self Inductance → The phenomenon of the production of an induced e.m.f. in a circuit itself due to change in current through it is called self induction and induced e.m.f. is called back e.m.f.
So, when the current in a coil is switched on, the self-induction opposes the growth of the current and when the current is switching off, the self induction opposes the decay of the current. So self induction is also called as inertia of electricity.

Coefficient of Self Induction. Magnetic field at any point due to current carrying coil is directly proportional to the current, therefore magnetic flux (ϕ_B) passing through the coil (A coil of N turns) will be proportional to the current I

$$N\phi_B \propto i \Rightarrow N\phi_B = Li \Rightarrow L = \frac{N\phi_B}{i} \quad \text{---} \quad (1)$$

Here L is coefficient of self induction. So coefficient of self induction of coil is equal to the number of flux linkages with the coil when unit current is flowing through the coil.