Experiment:

Faraday's Law of Electromagnetic Induction

Induction method and Electromagnet Manufacturing

Apparatus:

We will need following components for the manufacturing of an Electromagnet

- **Galvanometer** to measure the intensity and direction of Electric current.
- An **LED** light
- We will need some Copper wires (Insulated) of length 2m.
- We will need a magnet

Theory:

So, basically, we will put a conductor in a changing magnetic field or rotate the coil in a uniform magnetic field, we will get voltage from this phenomenon. The first step is to take a coil and connect it with a galvanometer. After that we will use a magnet to produce current in the coil. First, we will move the magnet towards the coil. Due to this, we will see some deflection in galvanometer. The needle of the meter will start to move and will be back to its previous position if we make the magnet stationary at that point.

Now, when we will move the magnet away from the coil. Again, galvanometer will show some deflection but this time it will be in the opposite direction.

So, if you move the magnet around the coil, the galvanometer will show change in its readings.

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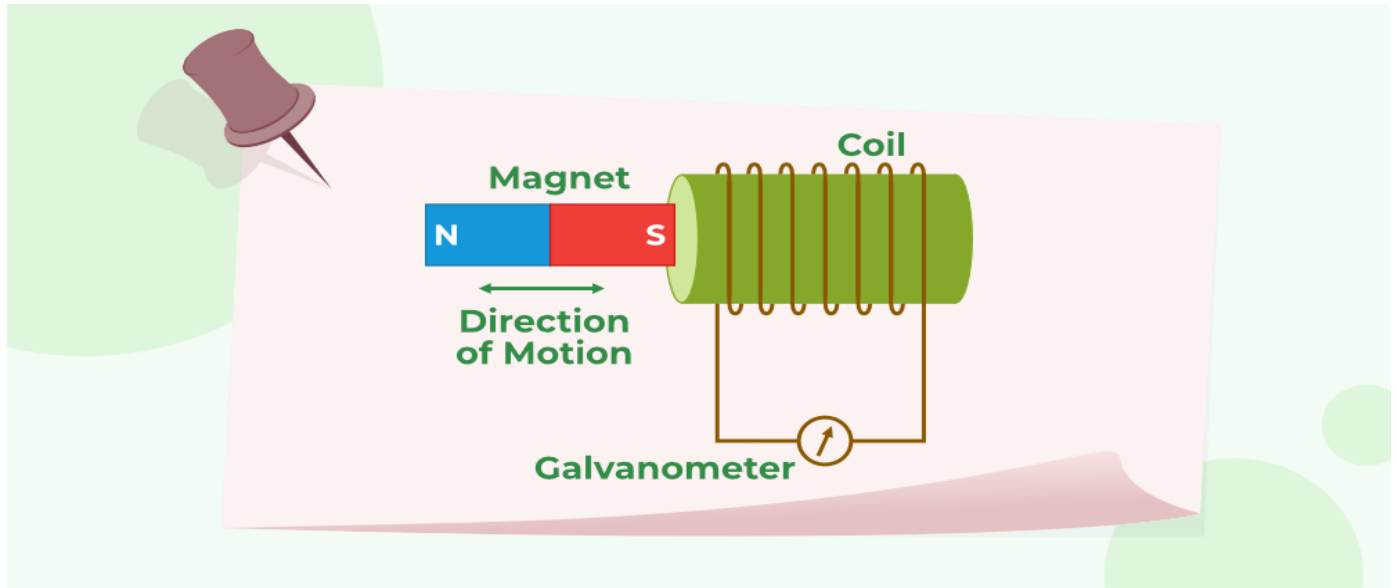
Viva Questions:

Question: Explain the concept of magnetic flux in the context of Faraday's Law…?

Answer: The amount of magnetic field lines that are travelling through a specific area is referred to as magnetic flux when referring to Faraday's Law of Electromagnetic Induction. It is a fundamental idea that aids in our comprehension of how a changing magnetic field interacts with the current or electromotive force (emf) created in a conductor.

The magnetic flux () is calculated mathematically as the product of the magnetic field strength (B) and the area (A) that the field lines pass through. The formula for it is = B * A * cos (), where is the angle formed by the magnetic field and the local normal.

$$\text{Formula: } \Phi = B * A * \cos(\theta)$$

Question: How is the magnitude of the induced electromotive force (emf) related to the rate of change of magnetic flux?

Answer: The rate of change of magnetic flux has a direct relationship with the strength of the induced electromotive force (emf). The relationship can be described mathematically as follows:

$$\varepsilon = -d\Phi/dt$$

where d/dt is the rate at which the magnetic flux changes and is the induced emf. The induced emf opposes the change in magnetic flux as indicated by the negative sign. The Faraday Law of Electromagnetic Induction describes this connection.

To put it another way, a faster rate of change in the magnetic flux via a conductor will result in a higher induced emf. In contrast, a slower rate of magnetic flux change will result in a smaller induced emf. Understanding how a changing magnetic field can cause an emf and subsequently a current in a device is based on this relationship.

Question 3: Faraday's law and its applications…?

Answer: Faraday's Law of Electromagnetic Induction states that a changing magnetic field induces an electromotive force (emf) in a conductor, resulting in the generation of an electric current. This law establishes a fundamental relationship between magnetic fields and electric currents.

Applications:

Electric generators: Electric generators, which transform mechanical energy into electrical energy, operate on the basis of Faraday's Law. The fluctuating magnetic flux that the rotating coil encounters in a magnetic field causes an emf that propels the flow of electric current.

Wireless charging: Wireless charging technologies make use of Faraday's Law. It is possible to wirelessly transfer energy to charge devices like smartphones or electric cars by inducing an emf in a receiving coil using magnetic fields.

These are some of the applications of Faraday Law.