Al- Mustaqbal University

College of Science

Medical Physics Department

First Stage

جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

Practical Electrical Lab

Lecture third : electromagnetic induction

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The aim of the electromagnetic induction experiment:

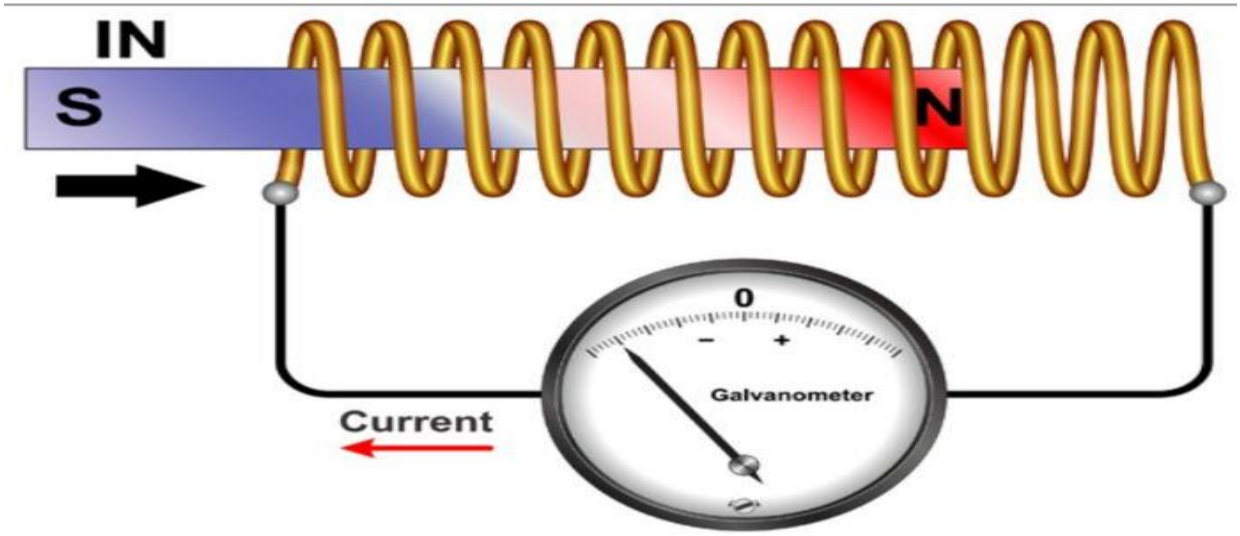
1.Understanding the principle of electromagnetic induction.

2.Practical verification of Faraday's law of induction.

3. Studying the factors affecting induced electromotive force (EMF).

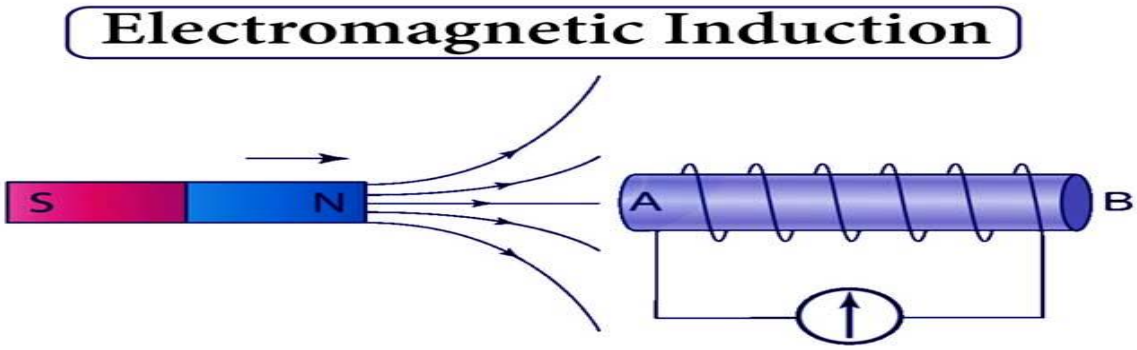
Tools and Equipment:

1. **Copper coil (solenoid).**
2. **Bar magnet.**
3. **Sensitive galvanometer or voltmeter.**
4. **Alternating current (AC) power supply.**
5. **Electrical switch.**
6. **Iron core.**
7. **Connecting wires.**



What is electromagnetic induction?

Michael Faraday is generally credited with the discovery of induction in 1831, and James Clerk Maxwell mathematically described it as Faraday's law of induction. Lenz's law describes the direction of the induced field. Faraday's law was later generalized to become the Maxwell–Faraday equation, one of the four Maxwell equations in his theory of electromagnetism.



Electromagnetic induction:

is the production of an electromotive force (emf) across an electrical conductor in a changing magnetic field.

Faraday's law states that:

the electrical drive induced in an electrical circuit is directly proportional to the time rate of change in the magnetic flux passing through.

Lenz's law states that:

The direction of the induced electromotive force in a circuit is opposite to the change that caused it.

Factors affecting electromagnetic induction:

1. Minimal flux change rate.
2. Number of turns in the coil.
3. Magnetic field strength.
4. Presence of an iron core.
5. Coil area.

Procedure:

1. Connect the ends of the coil to the galvanometer.
2. Insert the magnet into the coil at a constant speed.
3. Observe the deflection of the galvanometer needle.
4. Remove the magnet and observe the change.
5. Repeat the experiment at different speeds.

The mathematical formula for Faraday's law:

$$\mathcal{E} = -N\frac{d\Phi_B}{dt}$$

ε: Electromotive force, measured in volts.

Δϕ: Change in magnetic flux, measured in webers.

N: Number of cycles. **Δt: Change in time.**

- **The negative sign(−) in Faraday's law refers to Lenz's law.**

Q1/ A uniform magnet is passed through a coil with 400 turns. This results in a magnetic flux of 3 Weber. Calculate the electromotive force (EMF) generated in the coil if the magnetic field disappears in(1) second.

Q2/A uniform magnet is passed through a coil with 200 turns. This results in a magnetic flux of 8 Weber. Calculate the electromotive force (EMF) generated in the coil if the magnetic field disappears in (2) second.