

28 - Electromagnetic induction

Q-1) What is electromagnetic induction?

- > It's producing a voltage or current by a changing magnetic field.

FLEMING'S RIGHT-HAND RULE.

Thumb : Motion of conductor

First finger : Magnetic Field

Second finger : Current or induced e.m.f.

* Within the conductor, the conventional current is from -ve to +ve like in a battery.

Q-2) What is magnetic flux density?

- > It's the no. of field lines passing through a unit area in a perpendicular direction.

$$B = \frac{\phi}{A}, \text{ unit : Tesla (T)}$$

Q-3) What is magnetic flux?

- > It's the total no. of field lines passing through an area in perpendicular direction.

$$\phi = BA, \text{ unit : Weber (Wb)}$$

* One weber is the flux that passes through an area of 1m^2 when the magnetic flux density is 1 Tesla.

$$1\text{Wb} = 1\text{Tm}^2$$

Q-4) What is magnetic flux linkage?

- > It's the product of magnetic flux and number of turns of the coil.

$$\text{magnetic flux linkage} = N\phi = BAN$$

Q-5) What is Faraday's Law of electromagnetic induction?

- > The magnitude of the induced emf is proportional to the rate of change of magnetic flux linkage.

$$\text{emf} = \frac{\Delta(N\phi)}{\Delta t} = \frac{\Delta(BAN)}{\Delta t} = BLV$$

\downarrow
coil of wire
 \downarrow
straight wire.

Q-6) What is Lenz's Law?

- > The direction of the induced emf is such as to oppose the change which produces it.

Magnitude of induced emf depends on:

* Straight wire:

- Magnetic flux density
- Length of wire
- Speed of movement of wire

* Coil of wire:

- Magnetic flux density
- cross-sectional area of coil
- no. of turns of wire
- rate at which coil turns.

Q-7) Uses of electromagnetic induction.

- > Breaking of trains ; electromagnets causing Eddy currents in the rails.
- > Generators ; rotating a coil in a magnetic field.
graph : $\text{emf} = - \text{gradient of flux linkage}$
 \therefore emf is max when flux linkage is zero & vice versa.
- > Transformers ; AC in primary coil produces a changing magnetic field and emf is induced in the secondary coil.