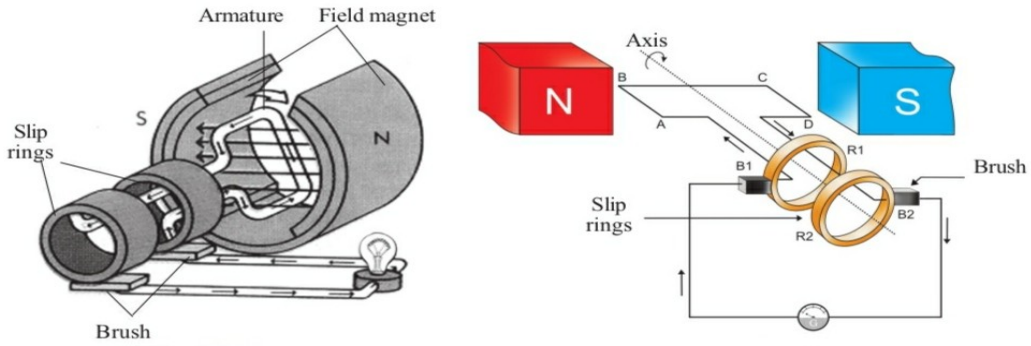
Physics Class Notes

Generator

Generator is device that converts **mechanical energy into electrical energy** by making use of **electromagnetic induction.**

1. AC Generator



Important Parts

- **Field magnet:** The magnet that creates magnetic flux in the generator.
- **Armature:** An arrangement of insulated conducting wire wound on a soft iron core. This can be made to rotate about an axis.
- **Slip rings:** Metal rings which are welded together with the armature coil. They rotate along with the armature on the same axis of rotation as the armature.
- **Brushes:** They are arrangements which always make contact with the slip rings. Current flows through them to the external circuit.

When the armature coil rotates about the axis in the clockwise direction, the portion AB moves upward and the portion CD moves downward.

Then according to Fleming's Right Hand rule,

1.What is the direction of induced current in the portion AB?

From A to B

2.What is the direction of induced current in the portion CD?

From C to D

3. What is the direction of induced current in the coil ABCD?

From A to D

4. What is the direction of induced current in the external circuit? (through the galvanometer)

From B_2 to B_1

At this time, the parts of the armature AB and CD will be moving in a direction perpendicular to the direction of magnetic field. Hence the flow of electricity will be maximum. When the armature turns by 90^0, the movements of the parts AB and CD are parallel to the direction of magnetic field. Hence the induced current will be zero.

When the armature completes 180^0 or one half rotation, at that instance,

1.What is the direction of movement of AB?

Downward

2.What is the direction of movement of CD?

Upward

3.What is the direction of current in the armature?

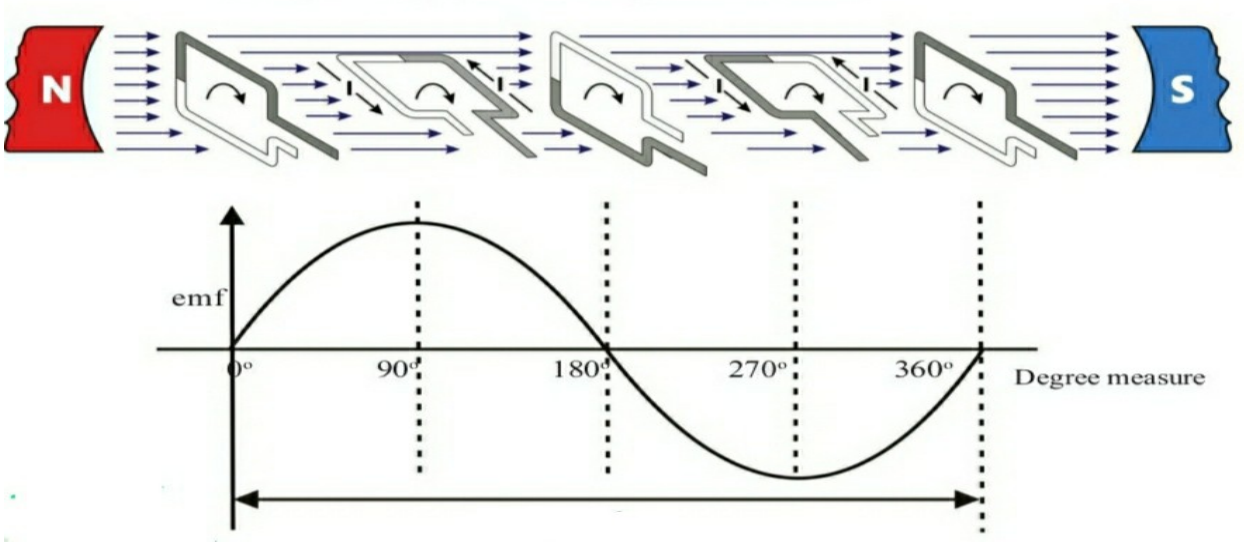
From D to A

4. What is the direction of induced current in the external circuit? (through the galvanometer)

From B_1 to B_2

The direction of current reverses every half rotation of the armature and the magnitude of current is increasing and decreasing. Such a generator which generates Alternating current is an AC generator.

The various stages of rotation of armature coil while completing one rotation in a magnetic field and the graph of the emf produced by the coil are shown below.



	Time				
	0	T/4	T/2	3/4 T	T
Angle of rotation of the armature	0^0	90^0	180^0	270^0	360^0
Rate of change of flux	0	maximum	0	maximum	0
Induced emf in volts	0	maximum	0	maximum	0

In an AC generator, the induced emf generated in the first half rotation in one direction and that generated in the second half rotation in the opposite direction together form the cycle of AC.

The time taken by the armature coil for a full rotation is called period (T).

The number of cycles per second is the frequency of AC. The frequency of AC generated for distribution in our country is **50 Hz.** That is, the direction of current changes 100 times in one second.

In an AC generator, the slip rings and brushes arrangement is used for taking out the current from the generator to the external circuit. In this system, brushes are sliding over the slip rings. The rubbing of slip rings on brushes may produce spark. If magnet is made to rotate instead of armature, slip rings and brushes can be avoided. So this method is being followed in heavy generators.