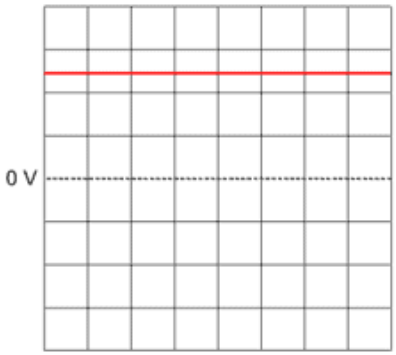
AC generator

Difference between DC and AC:

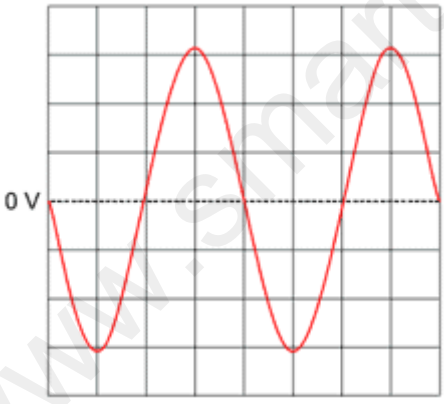
DC stands for direct current and AC stands for alternating current.

DIRECT CURRENT:



- A direct current flows in one direction only.
- Components that supply direct current are batteries and cells.
- The signal from a DC power supply looks like the following picture:

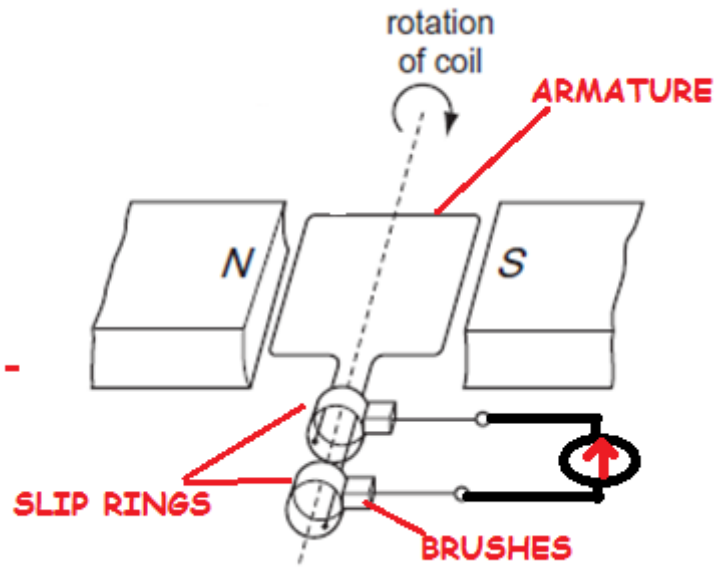
ALTERNATING CURRENT:



- Alternating current changes direction continuously.
- Mains electricity is an example of AC current. In India it is 230V AC
- The signal from a AC source looks like the following picture:

AC generator:

Construction and working



The Ac generator consists of an armature, slip rings, magnet, a suitable output.

Working:

When a conductor is moved through a magnetic field, it cuts the magnetic field lines and an emf is induced in the coil.

The coil is connected to a center zero galvanometer via the metal brushes. The brushes press against the slip rings and provide a connection between the coil and meter.

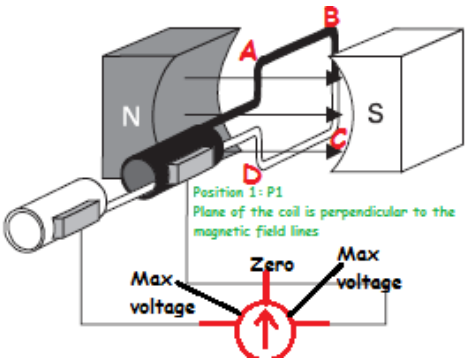
When the coil moves in one direction, the needle deflects in one direction and vice versa. This continues as long as the coil keeps rotating.

The direction of the induced emf changes constantly hence the direction of the current keeps changing after every half turn. Hence an alternating emf and an alternating current are produced.

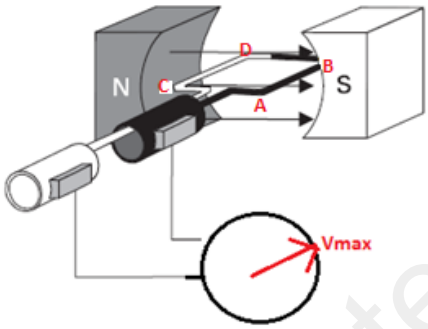
Interpreting the graph of the induced emf against time:

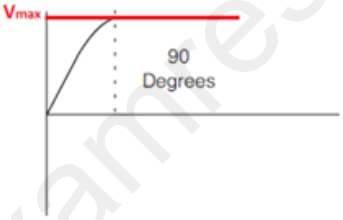
Working:

P1: The plane of the coil is perpendicular to the magnetic field lines, the armature conductors sides AB and CD are parallel to the magnetic field. Since no magnetic field lines are cut, the induced emf is 0V.So the needle points to 0V.

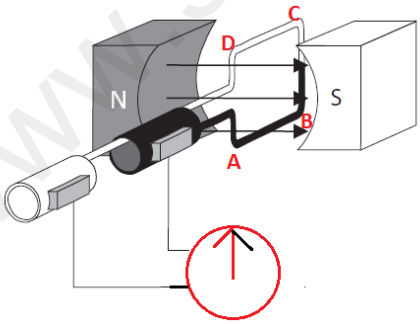


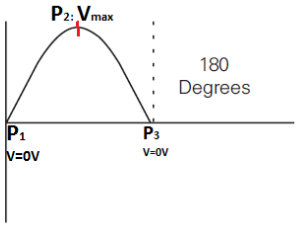
P2:When the coil rotates from 0 to 90^0,the sides AB and CD cut the magnetic field lines so the induced emf increases . It becomes maximum when the plane of the coil is parallel to the magnetic field lines. This is because in this position the sides AB and CD cut the magnetic field lines directly and needle points to one side giving maximum deflection.



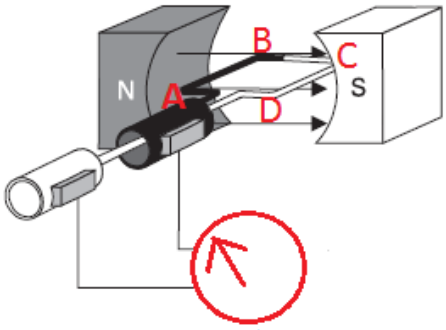


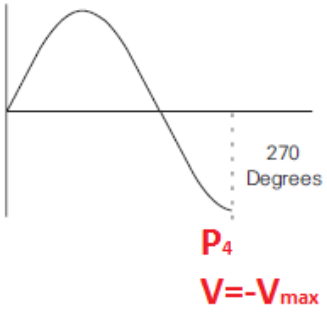
P3: The armature continues to rotate from 90^0 to 180^0.The induced emf decreases from maximum to zero volts where the plane of the coil is again perpendicular to the magnetic field lines. Note that the coil is upside down compared to its starting position(P1).



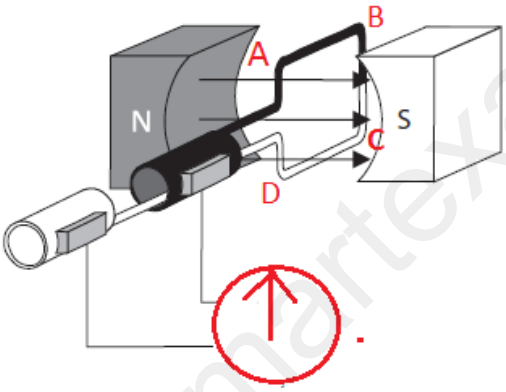


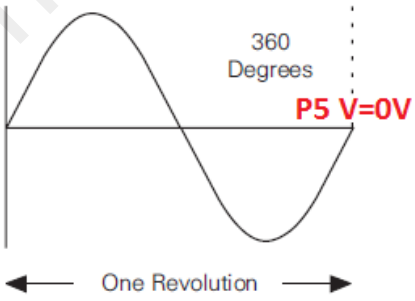
P4: When the coil rotates from 180^0 to 270^0,the sides AB and CD cut the magnetic field lines so the induced emf increases from 0 to negative maximum. It becomes negative maximum when the plane of the coil is parallel to the magnetic field lines once again but this time the coil is upside down compared to its original position.





P5: The armature further continues to rotate from 270^0 to 360^0. It is seen that that the emf increases from negative max to zero volts. This completes one cycle.





Note:

- **Role of slip rings:**

The slip rings help to maintain electrical contact between the coil and the external circuit(example , the meter)

- **Brushes:**
- The brushes are made of carbon

Difference between DC motors and AC generators:

Sr. No	Basis of comparison	DC motor	AC Generator
1	Type of energy conversion	Electrical to mechanical	Mechanical energy to electrical energy
2	Electricity	It uses electricity	It generates electricity
3	Principle	It is based on the principle: Current carrying conductor placed in a magnetic field experiences a force	Based on the principle of electromagnetic induction
4	Fleming's rule	Fleming's Left Hand rule	Fleming's Right Hand rule
5	Current	In a motor ,the current is supplied to the armature windings	In the generator, the current is produced in the armature windings
6	Commutator	DC motors use a split ring commutator	AC generators use a slip ring commutator

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APPLICATION BASED QUESTIONS-EXTENDED MCQ

10 Fig. 10.1 shows a coil of wire rotating steadily in the magnetic field between the poles of a permanent magnet. The current generated in the coil is to pass through resistor R.

M/J/14-P31

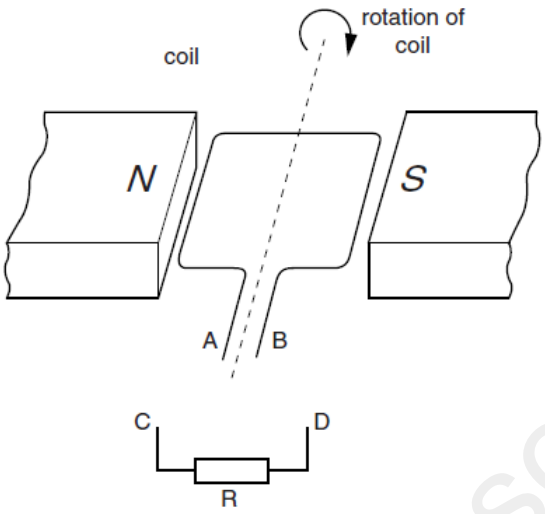

Fig. 10.1

(a) The apparatus in Fig. 10.1 is part of an a.c. generator. What is connected between the ends A and B of the coil and the connections C and D?

..... [1]

(b) **(i)** On Fig. 10.2, sketch a graph to show the variation with time of the current through R. [1]

Fig. 10.2

(ii) On Fig. 10.2, show the time *T* corresponding to one complete rotation of the coil. [1]

(iii) State **two** ways in which the graph would be different if the coil spins at a faster rate.

1. .....

2. ..... [2]

(c) Suggest what could be connected between C and R so that the current in R is always in the same direction.

..... [1]