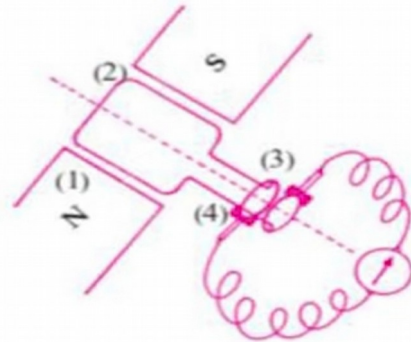


## UNIT 3 Electromagnetic Induction

15/09/2020 – Class 20

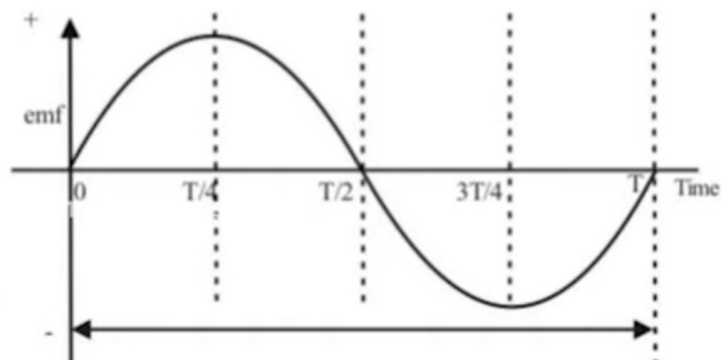
### Assignment Answer

- 1)  
a) Write down the names of parts numbered?  
**1. Magnetic poles, 2. Armature, 3. Slip ring, 4. Graphite brush.**  
b) State the working principle of this device?  
**Electromagnetic induction**



- 2) Analyse the graph and find out the instances at which the emf is maximum and minimum?

**Emf becomes maximum when the armature reaches  $90^\circ$  and  $270^\circ$ . It becomes minimum at  $180^\circ$  and  $360^\circ$ .**

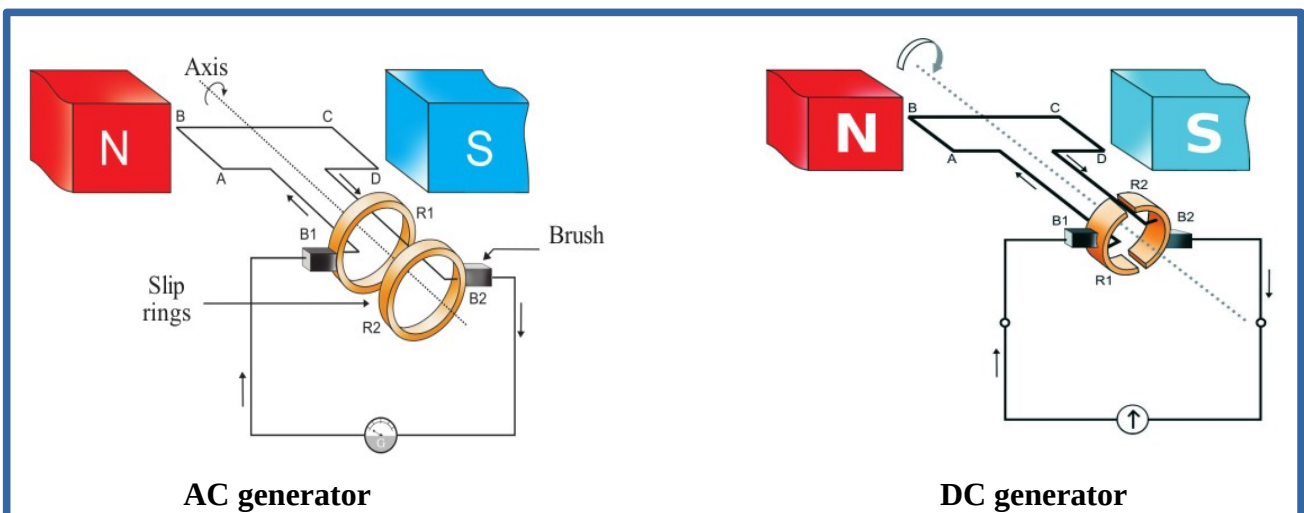


- 3) Complete the given table, based on the above graph?

	Time				
	0	T/4	T/2	3/4 T	T
Angle of rotation of the armature	$0^\circ$	$90^\circ$	$180^\circ$	$270^\circ$	$360^\circ$
Rate of change of flux	0	maximum	0	<b>maximum</b>	<b>0</b>
Induced emf in volts V.	0	maximum	0	<b>maximum</b>	<b>0</b>

### Activity 1

Observe the structure of an AC generator and DC generator.





### Discussion

- What is the difference between the structure of an AC generator and DC generator? **Instead of the slip rings of an AC generator there are split rings in a DC generator.**

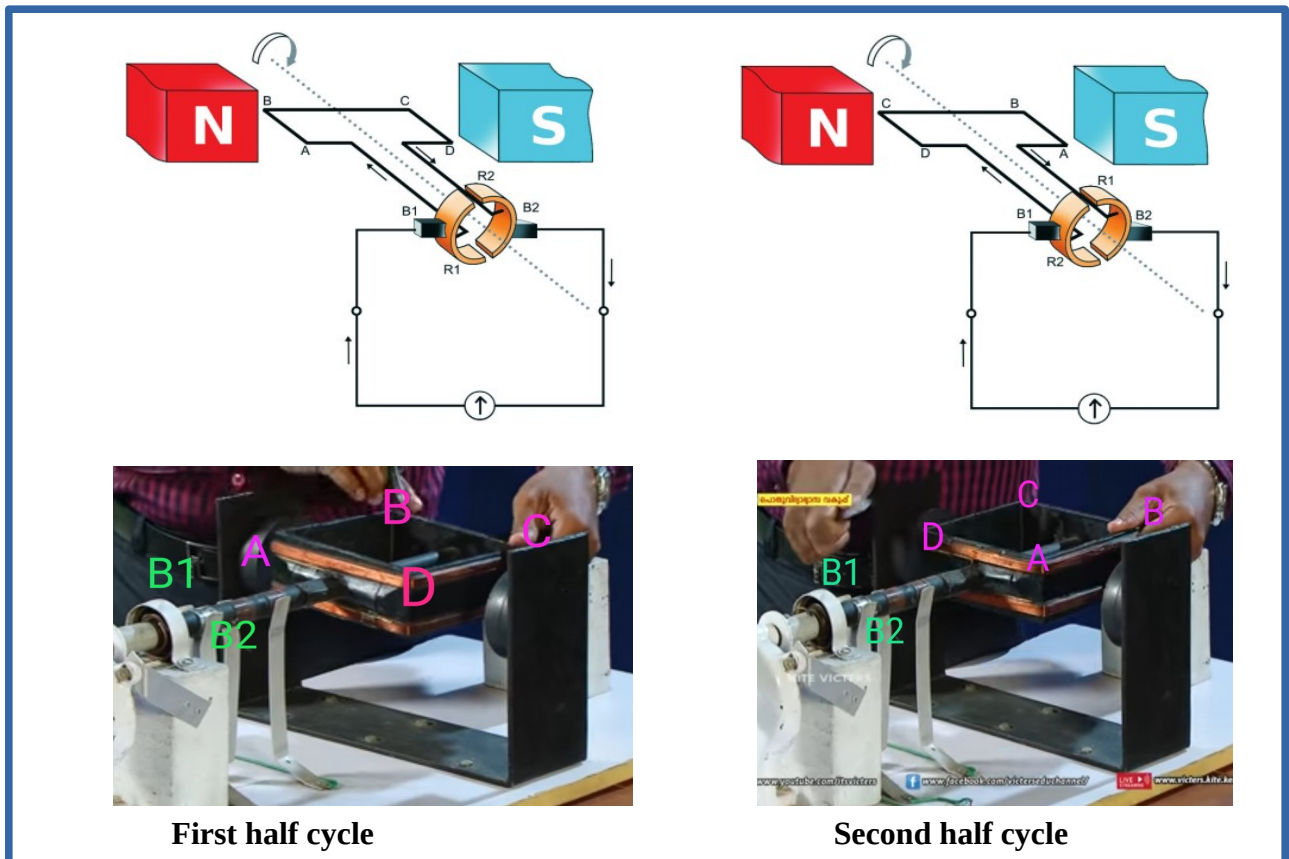
### Inference

In AC generator armature is connected to slip rings. But in DC generator armature is connected to split rings.

### Activity 2

Working of a DC generator.

Observe the figure, which shows the first and second half cycle of armature coil of a DC generator.



### Discussion

- Armature rotates in which direction? **Clockwise direction**
- Which law is used to find the direction of induced current formed in the armature? **Fleming's right hand rule.**
- In the first half cycle, side AB of the armature moves in which direction? **Upwards**
- In the first half cycle, side CD of the armature moves in which direction? **Downwards**
- What is the direction of current through the armature coil in the first half cycle? **ABCD**

- In the first half cycle, the side AB of the armature coil is in contact with which brush? **B1**
- In the first half cycle, the side CD of the armature coil is in contact with which brush? **B2**
- In the first half cycle, what is the direction of current in the external circuit? **B2 to B1**
- In the second half cycle, side AB of the armature moves in which direction? **Downwards**
- In the second half cycle, side CD of the armature moves in which direction? **Upwards**
- What is the direction of current through the armature coil in the second half cycle? **DCBA**
- In the second half cycle, the side AB of the armature coil is in contact with which brush? **B2**
- In the second half cycle, the side CD of the armature coil is in contact with which brush? **B1**
- In the second half cycle, what is the direction of current in the external circuit? **B2 to B1**
- Is the direction of current formed in the armature coil of a DC generator is changing? **Yes**
- Is the direction of current in the external circuit of a DC generator is changing? **No**
- Brush B1 is always in contact with which portion of the armature? **The portion that moves upwards.**
- Brush B2 is always in contact with which portion of the armature? **The portion that moves downwards.**
- Which part of a DC generator helps to produce unidirectional current in the external circuit? **Split ring commutator.**

### Inference

- Alternating current (AC) is produced in the armature coil of both the AC generator and DC generator.
- With the help of split ring commutator direct current (DC) is obtained in the external circuit of the DC generator.
- The current produced in the DC generator is fluctuating.

### Activity 3

Works the model of an AC generator. Two LED bulbs (which allows electricity to pass through only in one direction) are connected parallel to each other in the out put of the generator.

### Observation

Only one LED is glowing.

### Discussion

- Why only one LED is glowing? **In the external circuit, current flows unidirectionally.**

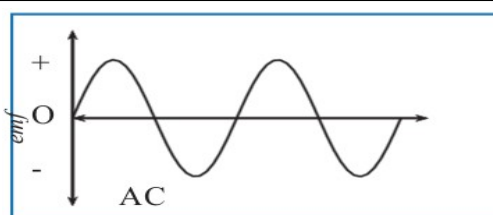


### Inference

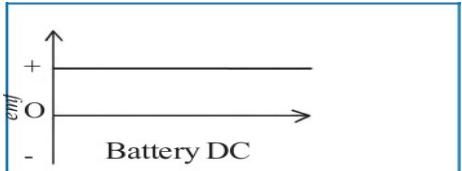
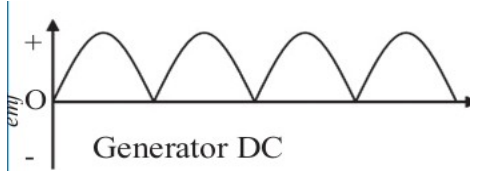
The out put of a DC generator is direct current (DC).

### Activity 4

Graphical representation of emf obtained from an AC generator, a battery & a DC generator are given.



- Direction changes continuously
- emf increases and decreases.

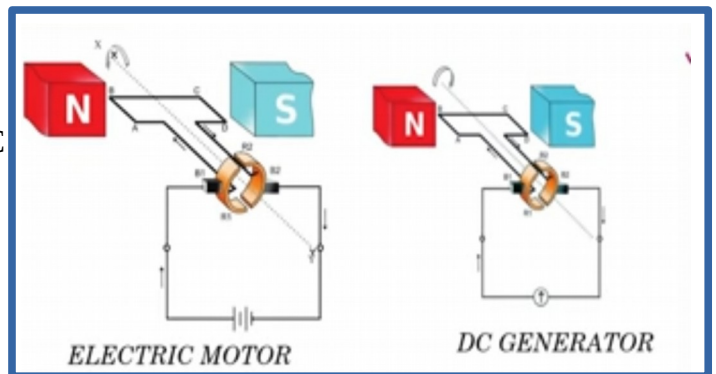
	<ul style="list-style-type: none"> <li>• Direction doesn't change.</li> <li>• emf doesn't change.</li> </ul>
	<ul style="list-style-type: none"> <li>• Direction doesn't change.</li> <li>• emf increases and decreases.</li> </ul>

### Activity 5.a

Observe the picture of a DC motor and DC generator.

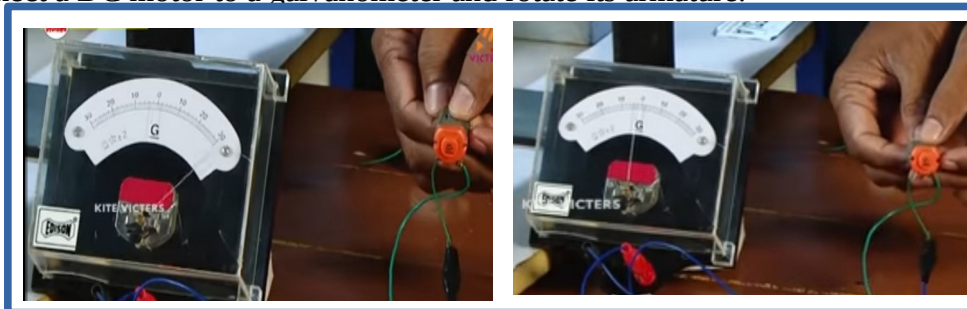
### Discussion

- Which are the parts of DC motor and DC generator? **Field magnet, Armature, Split rings, Brush**
- Is there any difference between the structure of a DC motor and DC generator? **No**
- What is the energy change in a DC motor? **Electrical energy is converted to mechanical energy.**
- What is the energy change in a DC generator? **Mechanical energy to electrical energy.**
- Can we convert a DC motor into a DC generator? **Yes.**



### Activity 5.b

Connect a DC motor to a galvanometer and rotate its armature.



### Observation

Galvanometer needle deflects towards one side and return to the centre.

### Discussion

- Why the galvanometer needle deflected? **Electricity is produced in the armature.**
- Why the galvanometer needle deflected towards one side only? **Direct current is produced in its output.**
- What is the energy change take place here? **Mechanical energy to electrical energy**

### Inference

If we rotate the armature of a DC motor, electricity is produced in it and it acts as a DC generator.

### Activity 6

What are the similarities and differences between DC motor and DC generator.

Similarities	Differences	
	DC motor	DC generator
Field magnet, Armature, Split rings and Brushes are the parts of both DC motor and DC generator.	Electrical energy is converted to mechanical energy	Mechanical energy is converted to electrical energy.
	Working principle is motor principle	Working principle is electromagnetic induction

### Activity 7

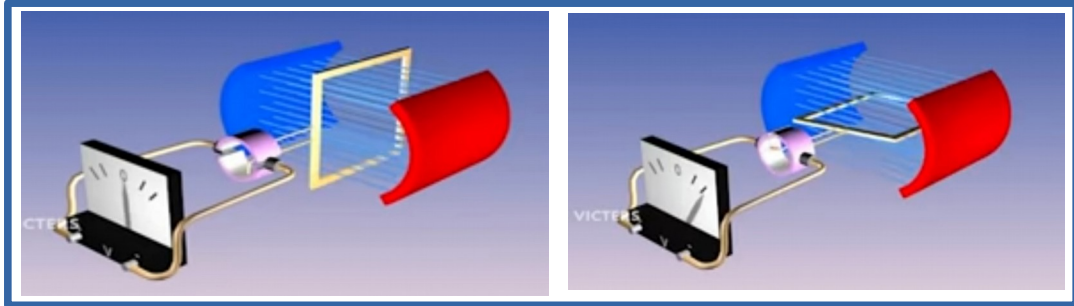
- How can we convert an AC generator into a DC generator? **Replace the slip rings of the AC generator by split rings.**

#### Inference

If split ring commutator is used in a generator instead of slip rings, we will get DC

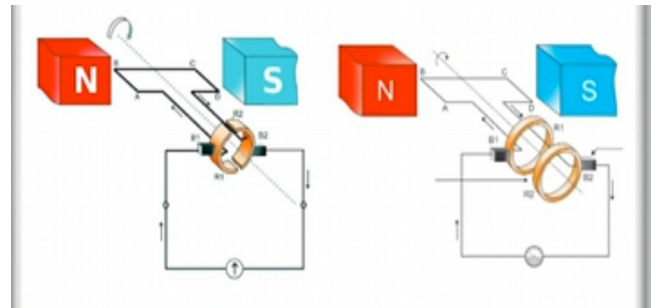
### Activity 7

Observe the animation showing the working of a DC generator.



### Assignment

- Line diagrams of two generators are given.
  - What is the speciality of the electricity reaching the galvanometer if the armatures of both the generators are made to rotate?
  - What is the speciality of the electricity reaching the galvanometer if the field magnets of both the generators are made to rotate?
  - Draw the graphical representation of electricity obtained in both?



- Electromagnetic induction is
  - Charging a substance.
  - Process of developing a magnetic field around a coil by passing electricity through a coil.
  - Process of rotating the armature of a generator.
  - Process of making electricity by the relative motion of a magnet or a coiled conductor.
- Which is the device used to generate electricity?  
(generator, galvanometer, motor, ammeter)
- Write down the similarities and differences in the structure of an AC generator and DC generator?