

# Basic Electrical Engineering (TEE 101)

## *Lecture 49:* *Introduction to* *DC Machines*

# Content

**This lecture  
covers:**

**Introduction to DC  
Machine**

**Working Principle  
of DC Machine**

**Construction of DC  
Machine**

**Advantages and  
Disadvantages of DC  
Machine**

# Introduction

A DC machine is an electromechanical energy alteration device.

DC machines are of two types:

- DC Generator
- DC Motors

The main function of the DC generator is to convert mechanical power to DC electrical power, whereas a DC motor converts DC power to mechanical power.

DC Generator or Motor are further classified on the basis of how the field is produced by the field system

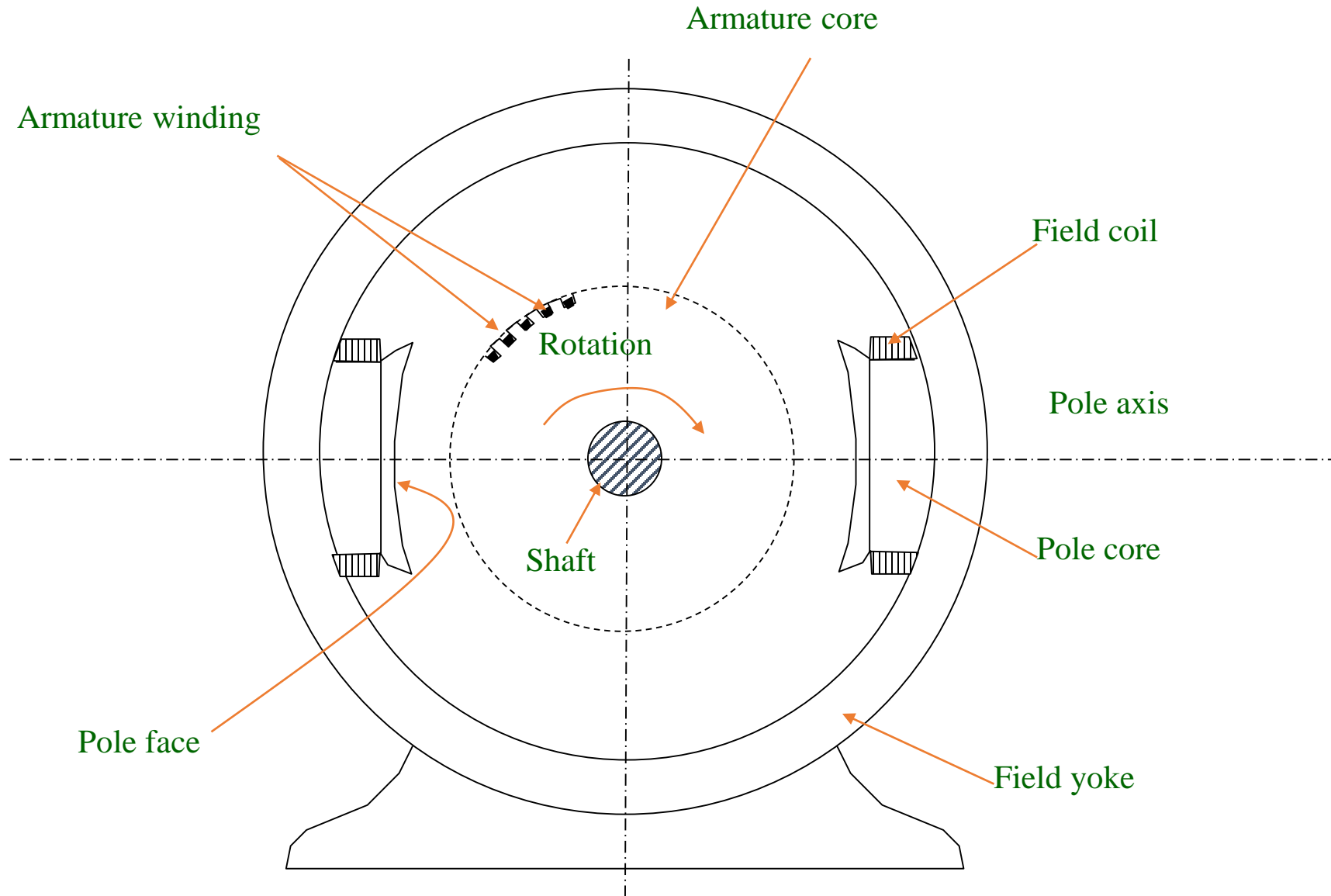
The broad categories are: Separately Excited DC Machines and Self Excited DC machines

Self Excited DC machines are further classified as: Series Wound, Shunt Wound and Compound Wound

# Construction of DC Machine

## Important parts of DC motor:

1. Yoke
2. Field winding
3. poles
4. Armature
5. Commutator, brushes & gear
6. Brushes

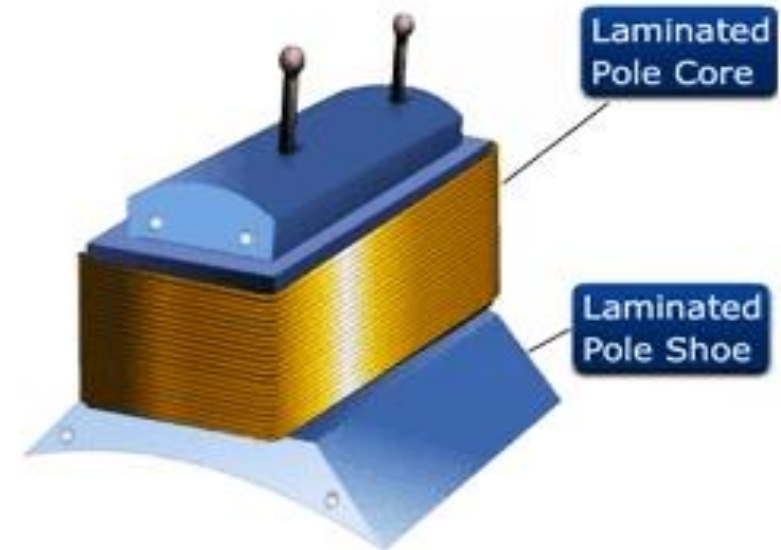
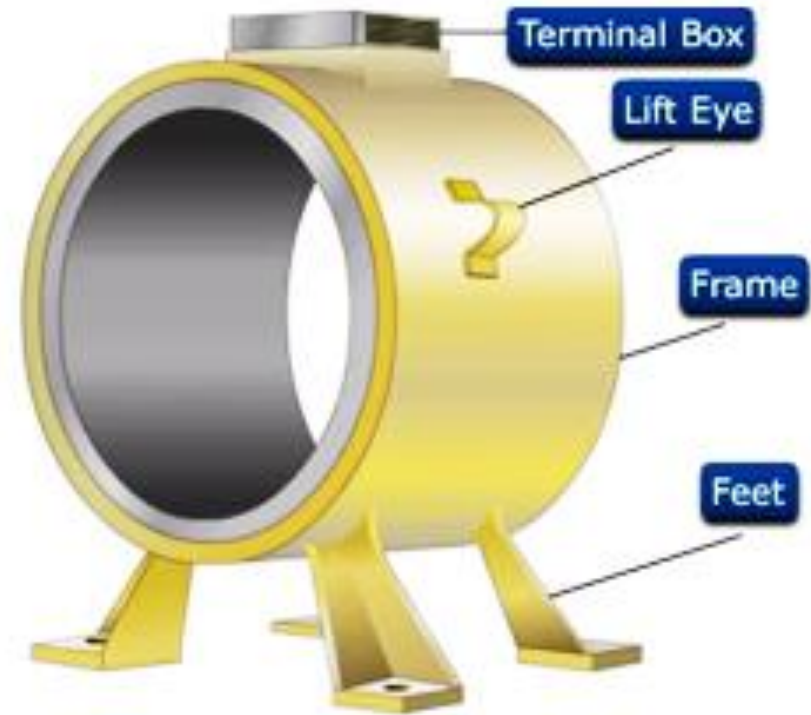


## 1. Yoke (Magnetic Frame) :

- It acts as the outer support of a DC motor.
- It provides mechanical support for the poles.
- It carries the magnetic flux produced by the poles.

## 2. Poles:

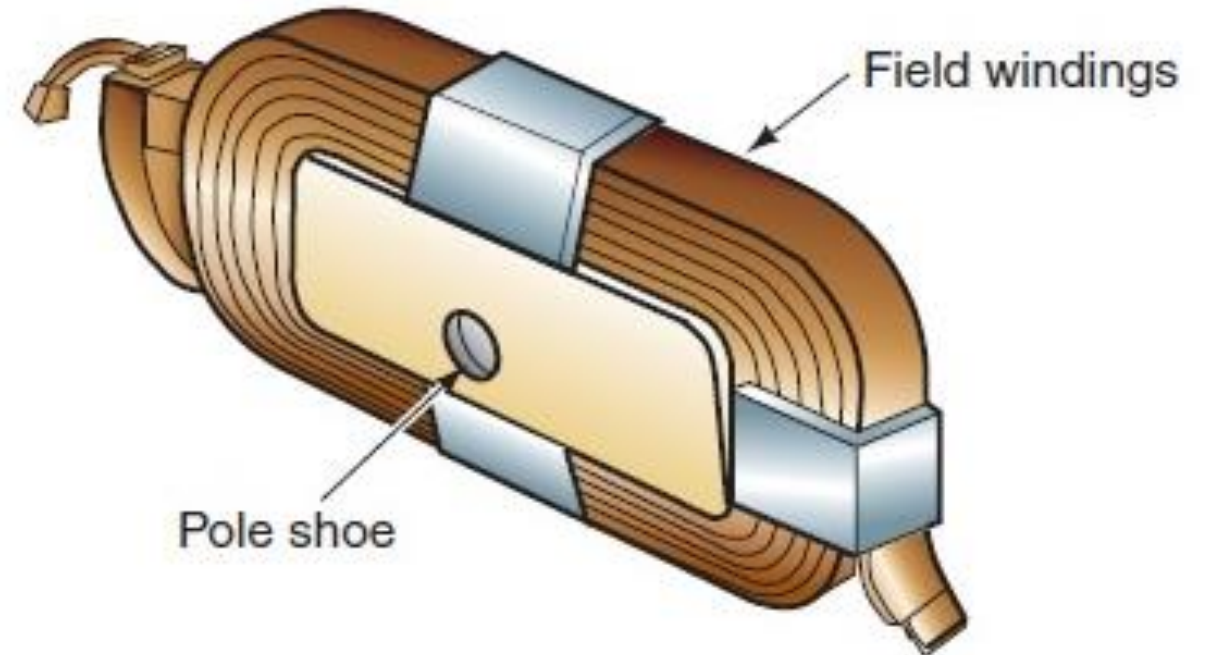
- pole of a dc motor is an electromagnet.
- The field winding is wound over the poles.
- Poles produces magnetic flux when the filed winding is excited.





### 3. Field winding:

- The coils wound around the pole are called field coils and they are connected in series with each other to form field winding.
- When current passing through the field winding, magnetic flux produced in the air gap between pole and armature.

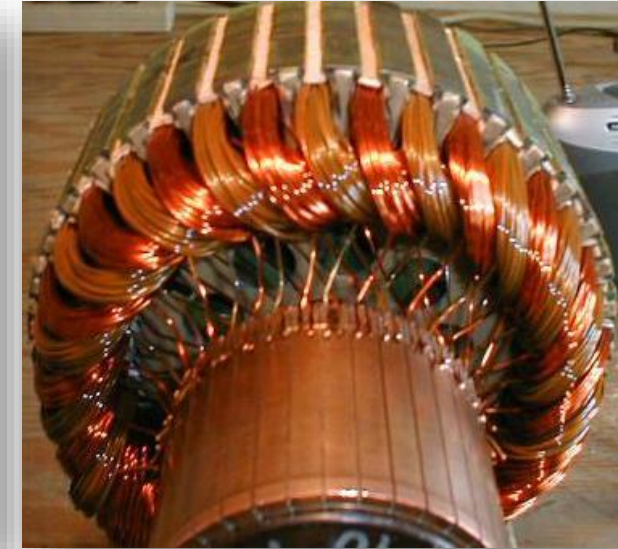
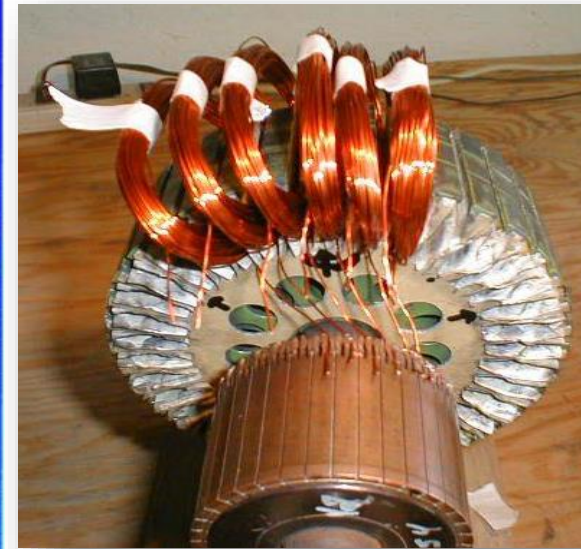
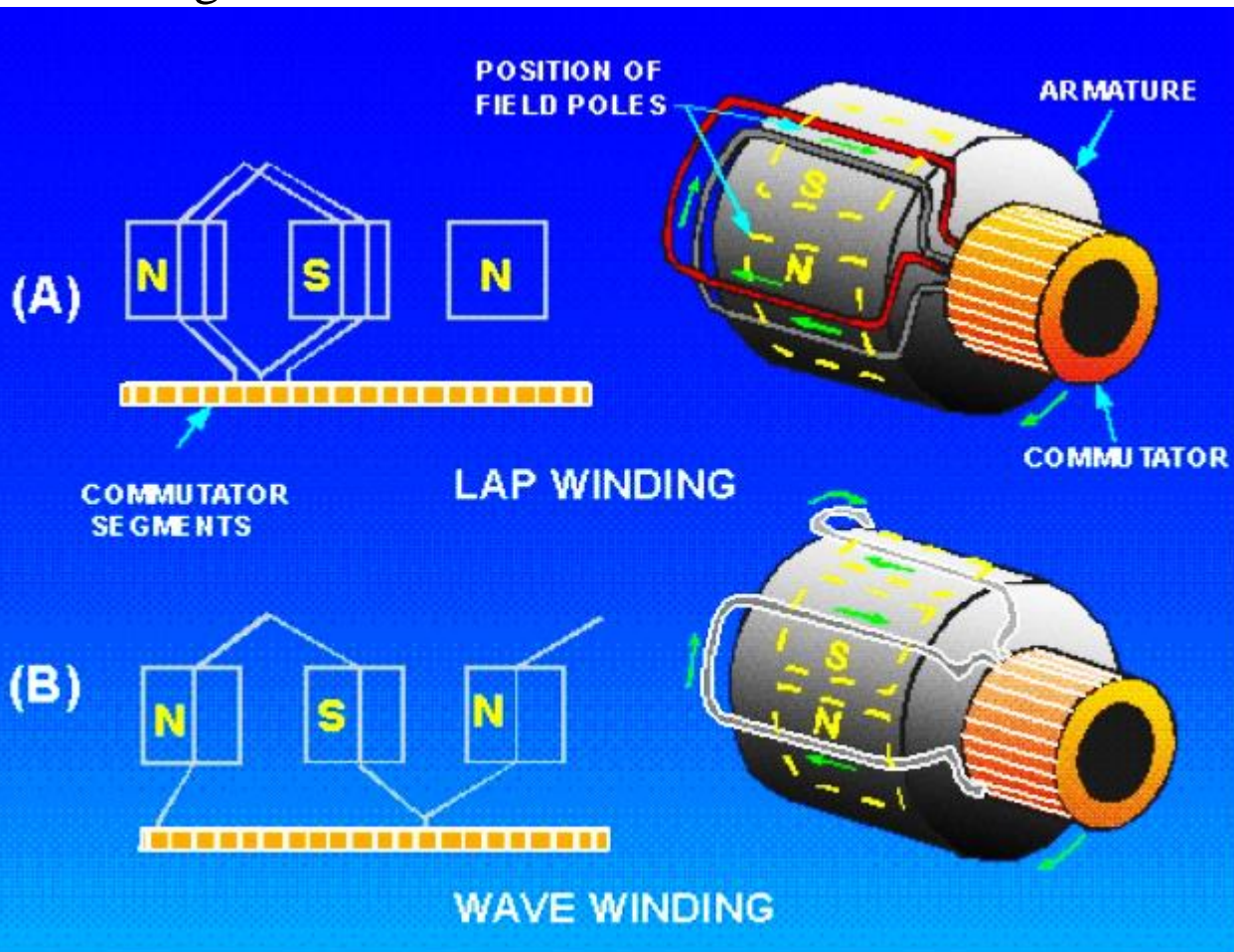
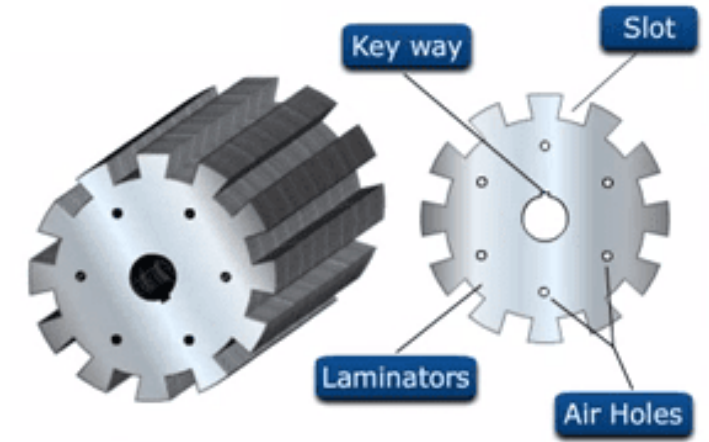


**FIELD COIL WOUNDED AROUND ON POLE SHOE**



#### 4. Armature:

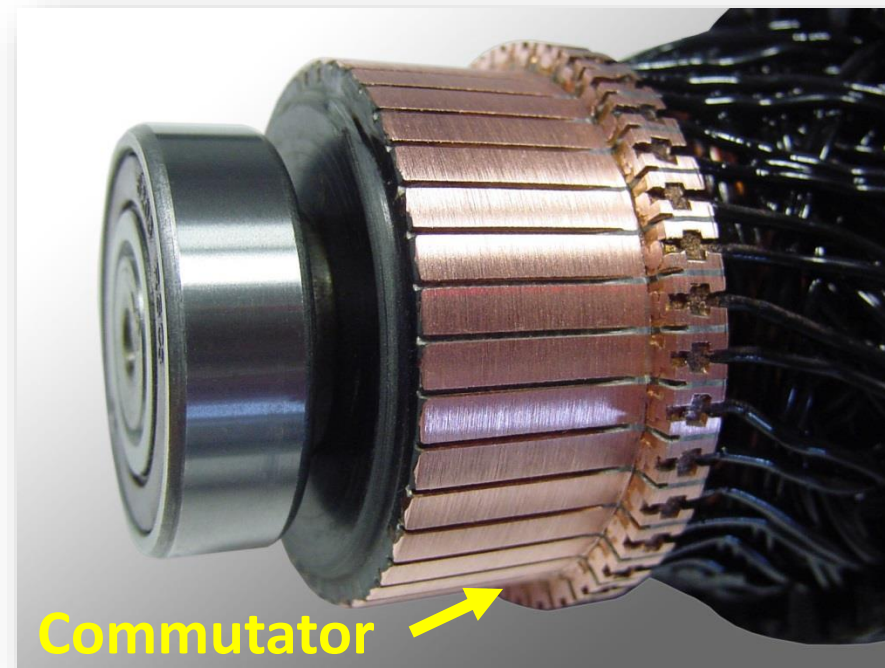
- Armature is a cylindrical drum mounted on shaft in which number of slots are provided.
- Armature conductors are placed in these slots.
- These armature conductors are interconnected to form the armature winding.





## 5. Commutator:

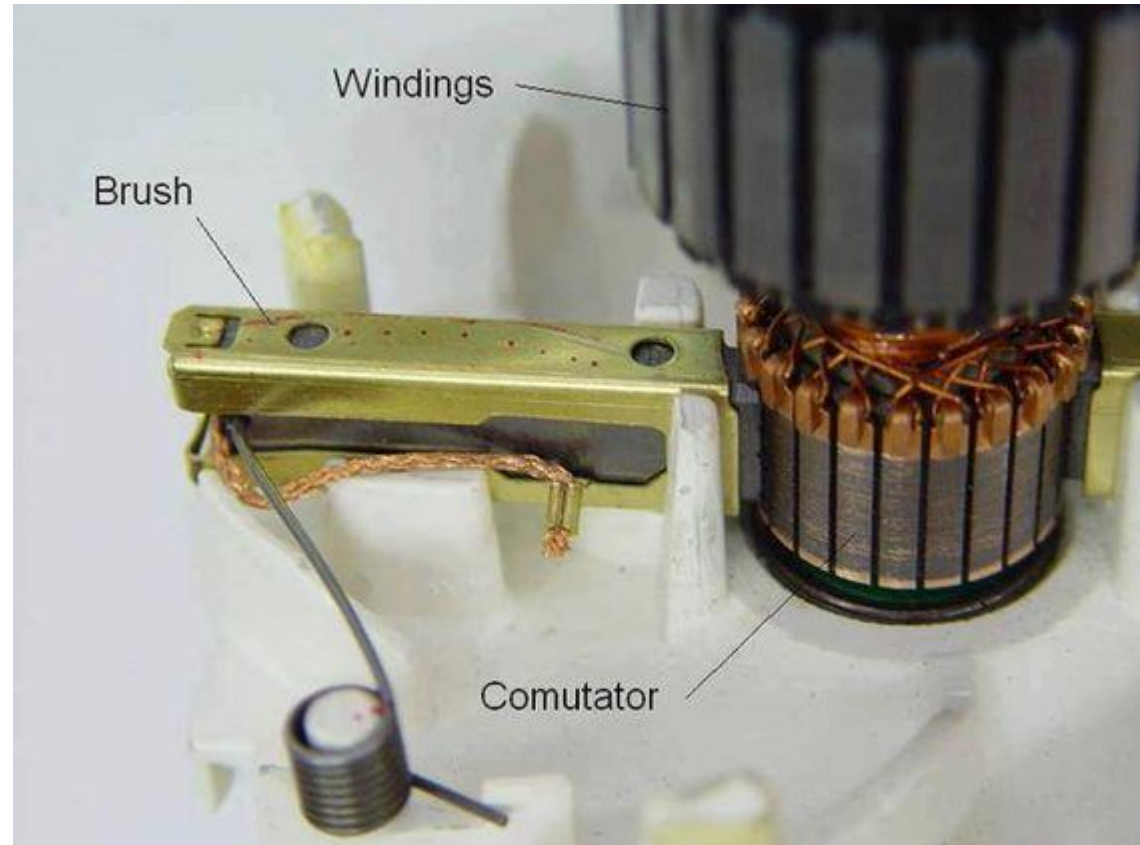
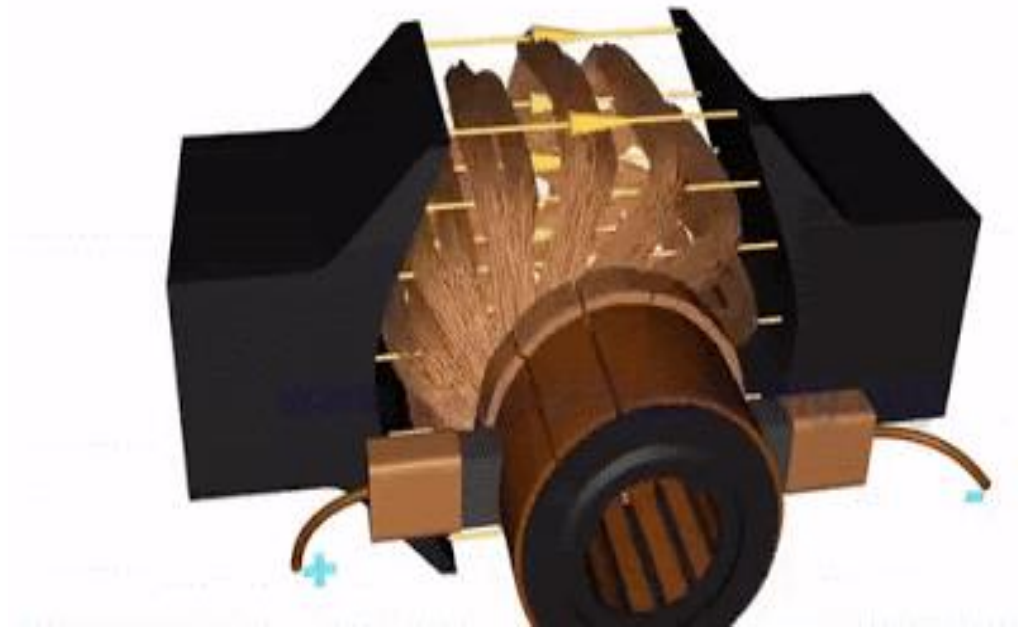
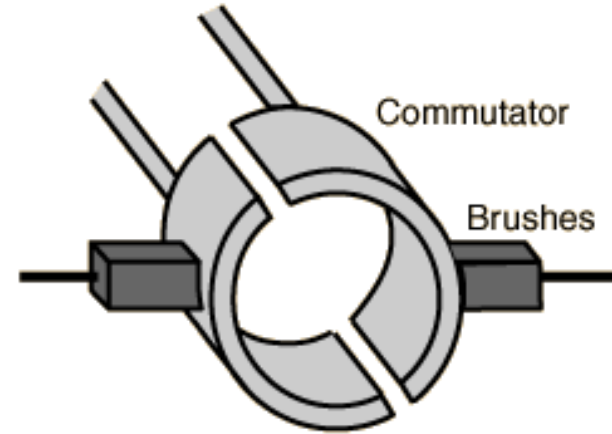
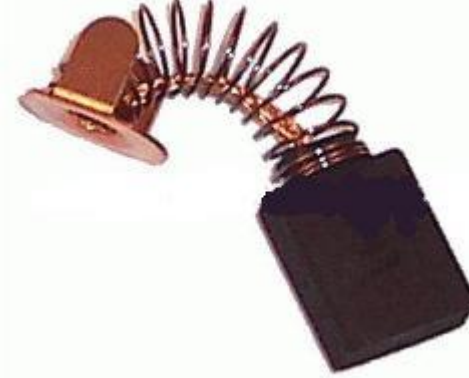
- Commutator is a mechanical rectifier, which converts the alternating voltage generated in the armature winding into direct voltage across the brush.
- It is made of copper segments insulated from each other by mica and mounted on the shaft of the machine.
- The armature windings are connected to the commutator segments.

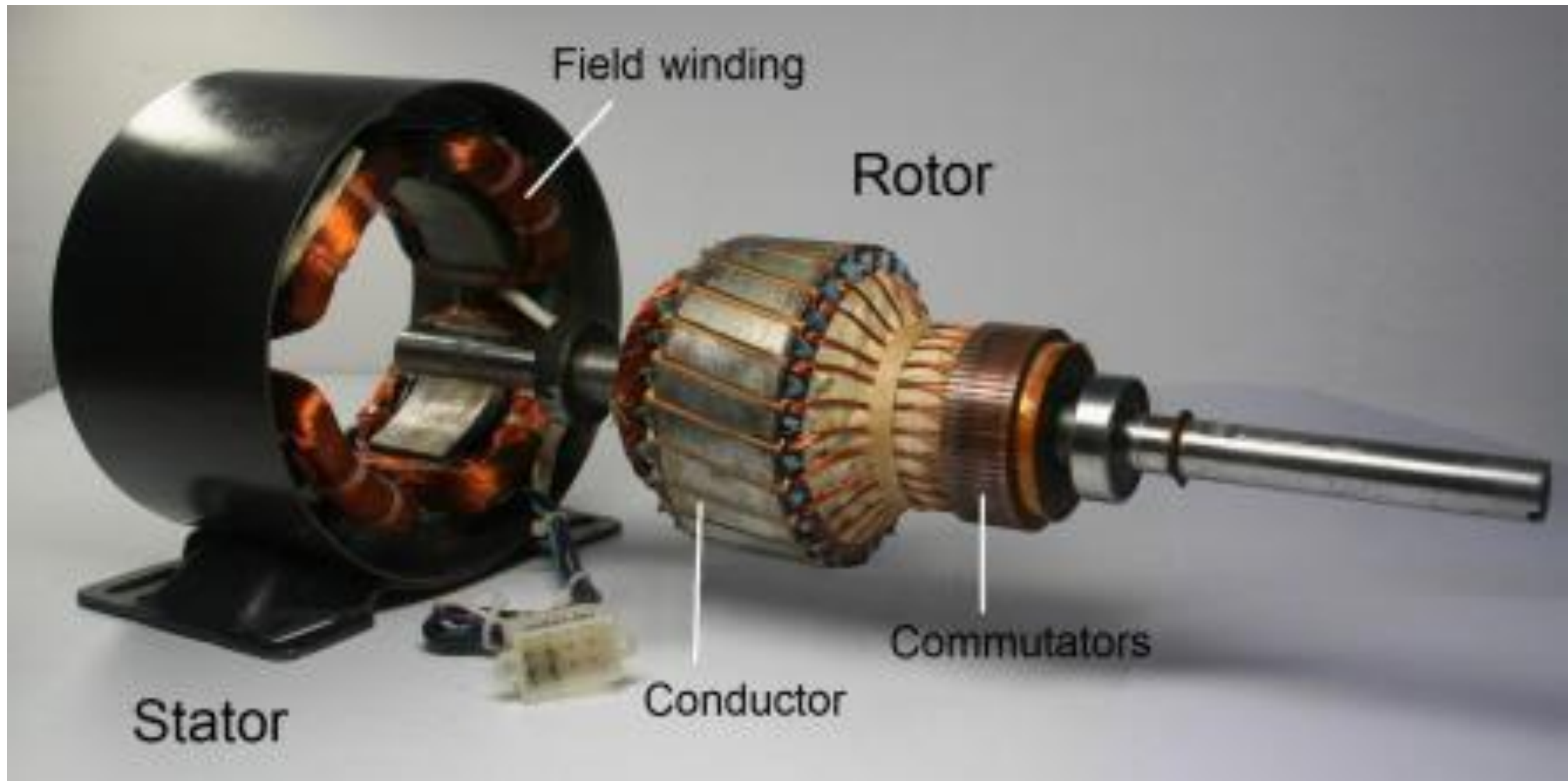




## 6. Brushes:

- Commutator is rotating. So it is not possible to connect the load directly to it.
- Hence current is conducted from the armature to the external load by the carbon brushes which are held against the surface of commutator by springs.

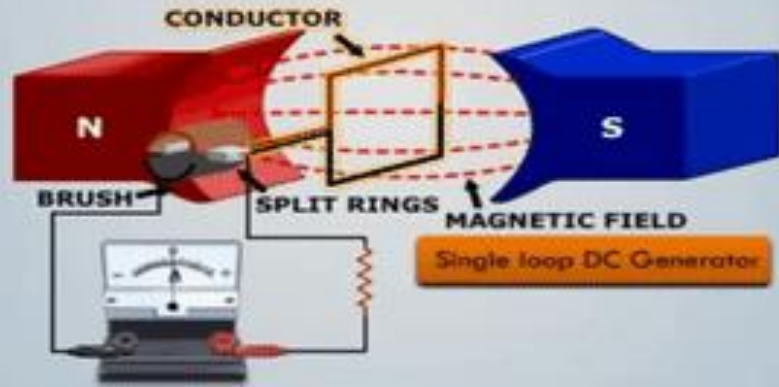




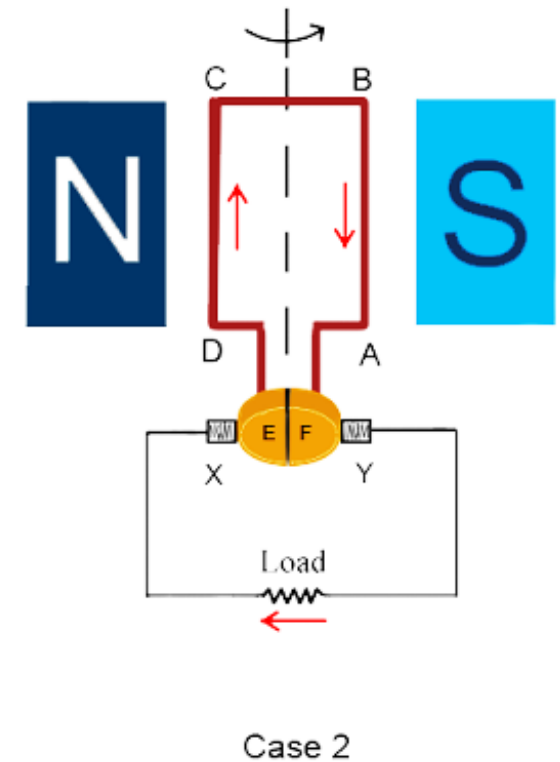
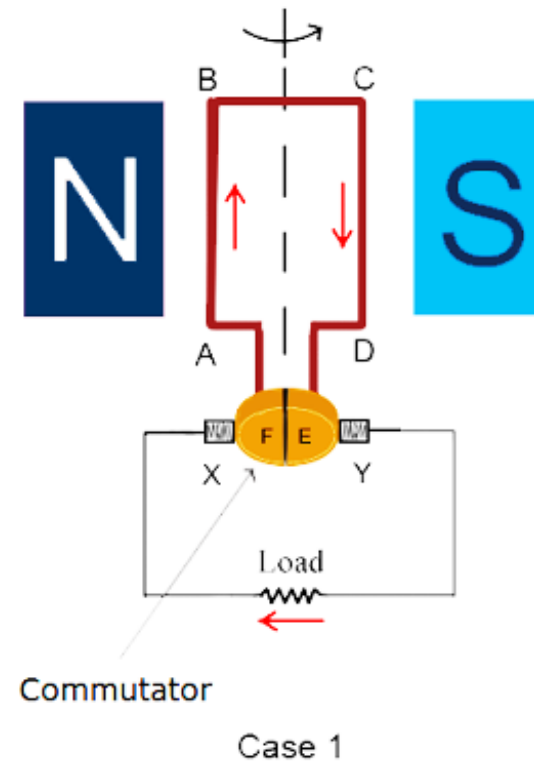
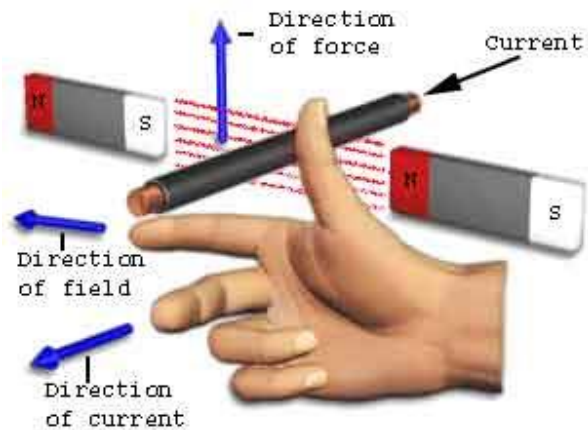
By: Dr. Parvesh Saini

# Working Principle of DC Generator

Explain the Principle of Operation of a DC Generator.



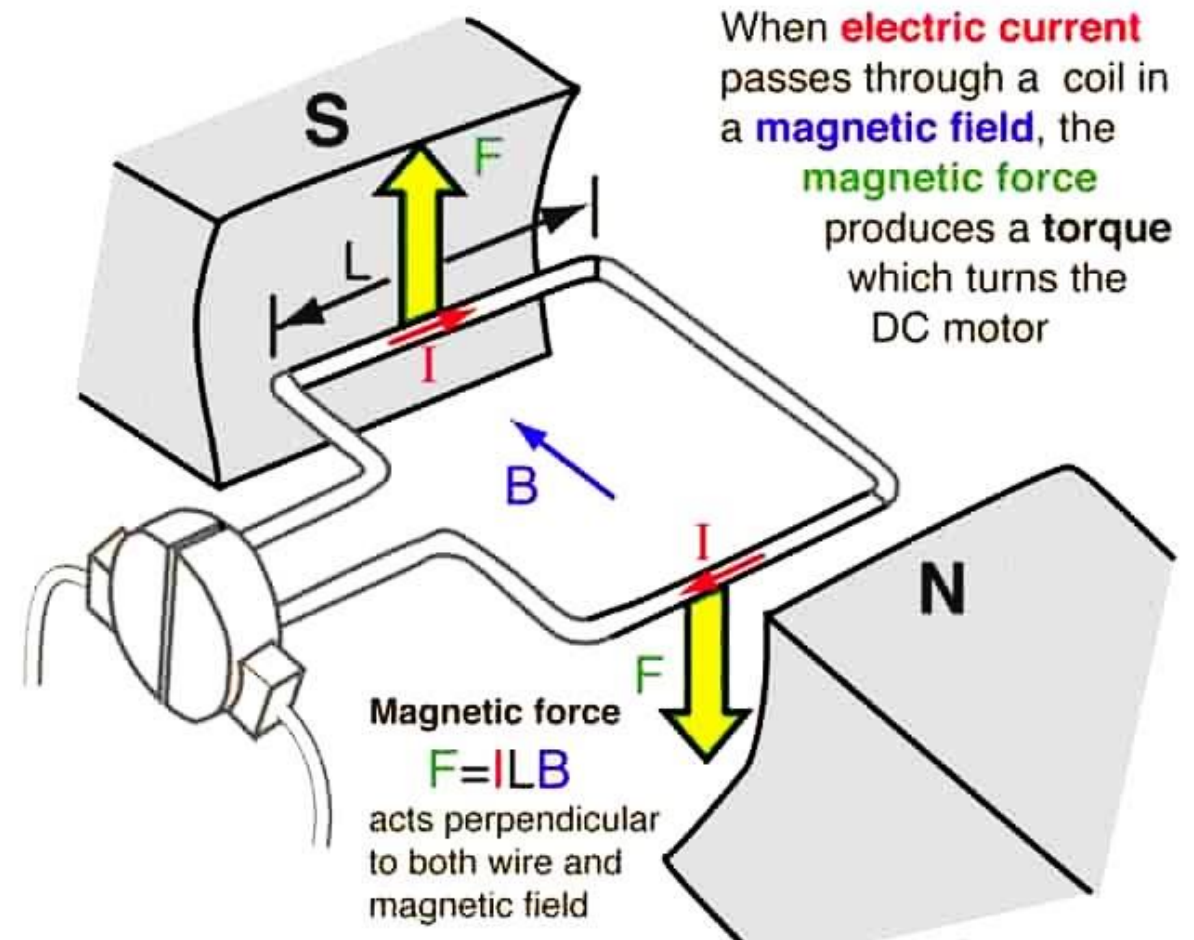
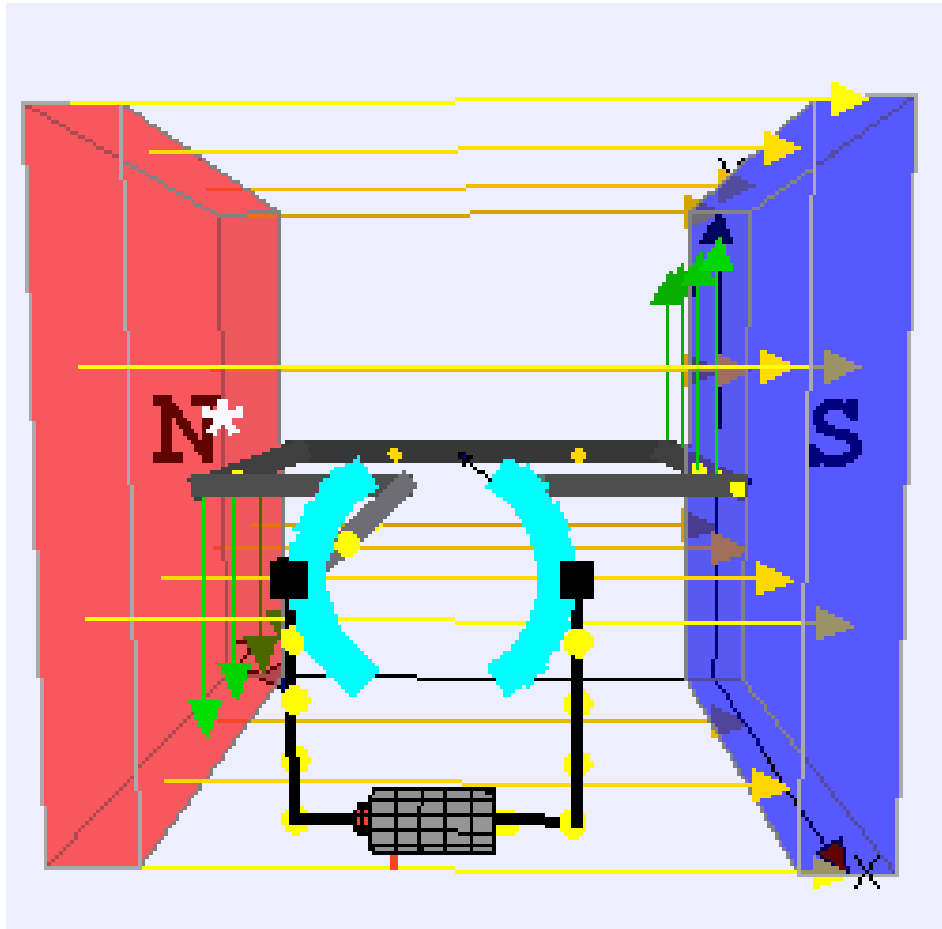
Fleming's Right Hand Rule



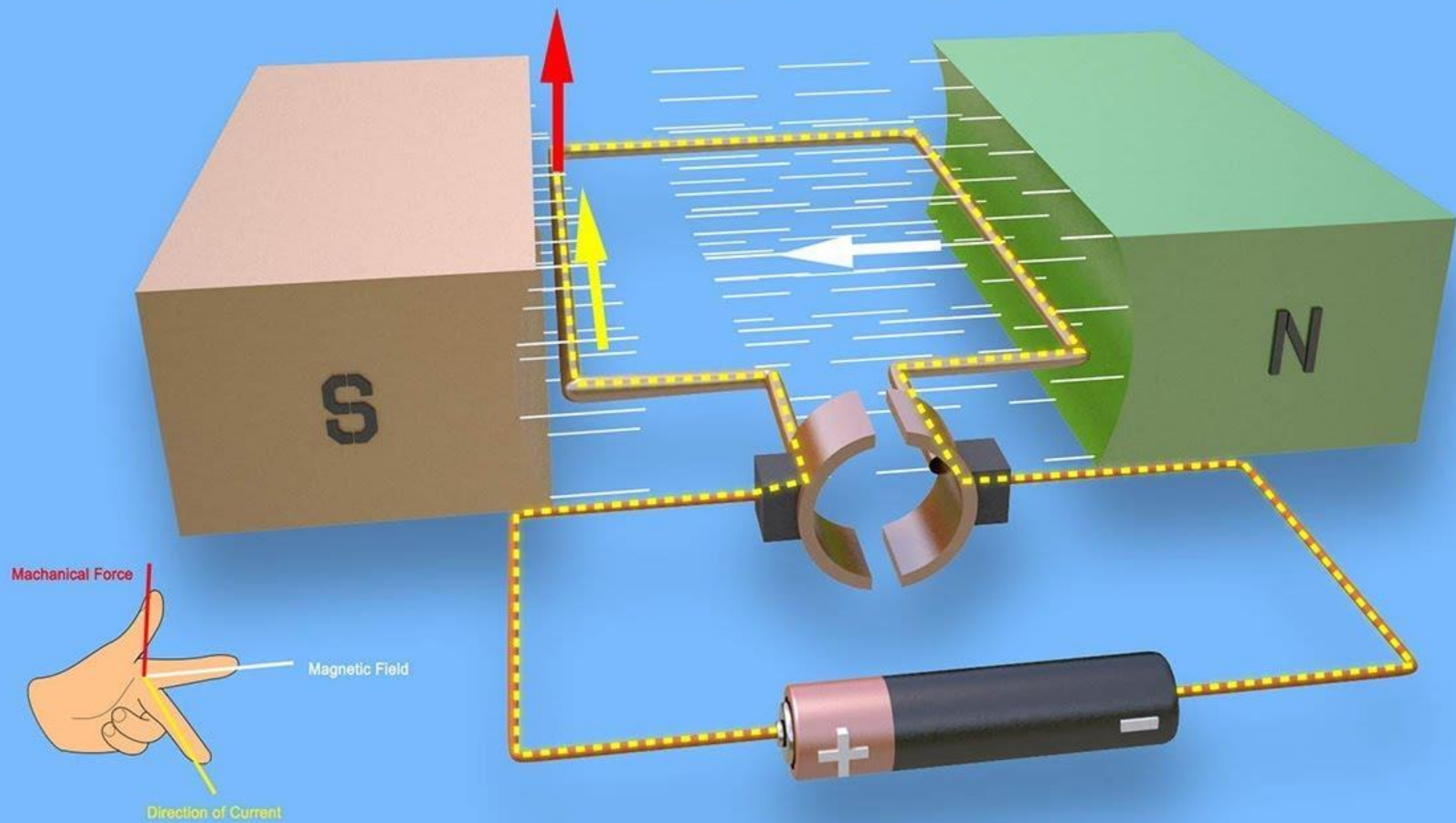
Works on Faraday's Law of Electro-magnetic Induction. It states that when a conductor is rotated in magnetic field, an emf is induced on the conductor. The direction this emf is given by Fleming's Right Hand Rule.



# Working Principle of DC Motor



# DC Motor



## **ADVANTAGES**

- **High starting torque**
- **Rapid acceleration and deceleration.**
- **Speed can be easily controlled over wide speed range.**
- **Used in tough jobs (traction motors, electric trains, electric cars,....).**
- **Built in wide range of sizes.**

## **DISADVANTAGES**

- **Needs regular maintenance (Brushes + Commutator).**
- **Cannot be used in explosive area.**
- **High cost (because of their complex armature construction).**
- **Larger in size for the same output**



**Thank You**