# Assignment- 03

**Subject:** Electrical Drives and Instrumentation Lab

**Subject Code:** (CSE-2304)

**Name:** Habibur Rahman

**ID:** 202231064012

# DC Motor

## Working principle of DC Motor:

A machine that converts direct current into mechanical work, is called a DC motor. The DC motor works on the principle of "Faraday's law of electromagnetic induction". Faraday's law of electromagnetic induction states that " Whenever a current-carrying conductor is placed in a magnetic field, it experiences a force"
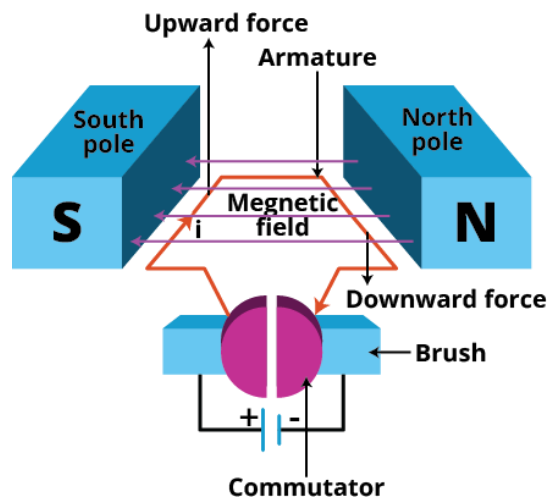


## Back emf in dc motor:

The back (or counter) electromotive force (emf) E is the voltage generated by a running motor that acts to counter the supplied voltage. In the simple case of a permanent-magnet DC motor, it is proportional to the rotational speed $\omega$, and written as $E = K_E\omega$.
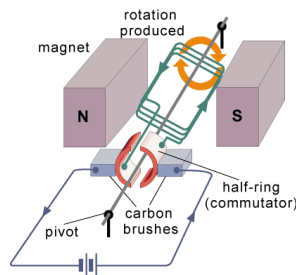
# Characteristics of DC Motors – Shunt, Series and Compound Motors :

The performance of a DC motor is given by the relation among the armature current, torque and speed. These relations are given graphically in the form of curves, which are called as characteristics of DC motors. These characteristics show the behavior of the DC motor under different load conditions.

**The three important characteristics of a DC motor:**

- **Torque and Armature Current Characteristics:** It is the graph plotted between the armature torque (τa) and the armature current (Ia) of a DC motor. It is also known as electrical characteristics of the DC motor.
- **Speed and Armature Current Characteristics:** It is the graph plotted between the speed (N) and the armature current (Ia) of a DC motor. This characteristic curve is mainly used for selecting a motor for a particular application.
- **Speed and Torque Characteristics:** The graph plotted between the speed (N) and the armature torque (τa) for a DC motor is known as the speed-torque characteristics. It is also known as mechanical characteristics of DC motor.

# Speed control method :

Speed control methods of DC motor is important in many industrial and commercial applications that demand precise control over rotational velocity. Speed control allows regulating the rate of many operations driven by DC motors. DC motors are an integral part of various industrial and domestic applications due to their versatility and ability to provide high torque at low speeds. Speed control methods of DC motor is crucial for ensuring optimal performance in different applications. In this article, we will discuss the various methods employed for speed control of DC motors, their working principles, advantages, limitations, and applications. With an in depth understanding of speed control techniques, one can optimize motor operations for efficiency and functionality. Let's delve deeper into the mechanisms of speed control for DC motors.

# Applications of DC Motor :

Motors were developed a long time ago and have been a blessing to people due to the convenience with which they can convert mechanical energy to electronic energy. It is therefore necessary to understand what Is a DC Motor and what principles it works on. In this article, we will also study the advantages and disadvantages of DC motors. We will discuss the applications of DC Motor in detail and later conclude the article by discussing some future trends of DC Motor. Readers are advised to go through the frequently asked questions in case of any doubts.

**DC Motor is an Industry:** DC motors usually have a high power output which can be used for driving various equipment, especially in industries. Therefore, DC motors are used in industries for converting one form of energy to another. The magnetic field generated in the motor is used for exerting force on the conductor generating enough torque to cause its mechanical rotation. This principle is applied to using machine tools, industry, and elevators. In an elevator, the motor drives the cable that holds the cable.

**DC Series Motor for Carrying a Load :** Cranes are known for carrying heavy weight at construction sites and some petroleum refineries where heavy material needs to be shifted from one place to another. The cranes that carry this load are powered by motors that give them the ability to hold a full load at zero and stop to apply brakes when needed. The small size of the DC motor makes it the best choice since it can be easily installed in cranes without adding much weight. DC motors can also be used in lifts for the same reason they are used in cranes.

**Shunt DC Motors in Centrifugal Machines :** DC motor is a specific type of motor with parallel windings that have the same voltage across them. The important characteristic of these motors is that they provide a constant speed i.e. high speed regulation with a high initial torque. Due to this, the DC motors are employed in centrifuge machines that need a constant torque that can be increased or decreased manually. This includes machines like Centrifugal Pumps, Lifts, Weaving Machines, Lathe Machines, Blowers, Fans, Conveyors, and Spinning Machines.

**DC Motor in Computer Peripherals :** The brushless DC motor is characterized by the absence of brushes and efficient energy conversion. This motor is capable of achieving high speed with full efficiency. The motor is used in various computer peripherals like disks, drives, and printers. This is because these devices need special speed control with discrete angular increments in order to ensure the proper working of these devices. The brushless DC motor is able to achieve this so that it can read/write head assembly across the spinning disks for reading and writing.

**DC Motor in Automobiles :** DC motor is used in a vast number of automobiles and even aircraft. The cars or other automobiles that operate on batteries, supply the necessary electrical energy to the motor which is then converted to mechanical energy due to the rotor rotation in the DC motor. the simple structure of these motors and efficient controls make them a good choice for retracting, and positioning the vehicles. They can also be used for controlling the side windows by operating them using the motor controls.