PRE-LAB QUESTIONS

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1. What are the major parts of the DC generators?

Ans The key parts of DC generators are yoke, poles, pole shoes, armature core, armature winding, commutator, brushes, magnetic field system, commutator, end housings, bearings, and Shafts.

2. Give the classification of AC machines.

Ans Based on the working principle, there are mainly three types of AC motors: Induction Motor, Synchronous Motor and AC Commutator Motor.

3. What is the use of brushes in DC motor?

Ans The brushes in a DC motor have two purposes.

1. They carry current to the armature (the rotating part).
2. The brushes work with the commutator to switch the current to the proper winding of the armature as it rotates. This creates the correct magnet fields to make the motor run. Essentially, a brush is one contact of a switch; the commutator is the other.

4. What is commutator?

Ans A commutator is a rotary electrical switch in certain types of electric motors and electrical generators that periodically reverses the current direction between the rotor and the external circuit. It consists of a cylinder composed of multiple metal contact segments on the rotating armature of the machine.

5. Why the armature of DC motor is laminated?

Ans:- the armature of DC motor is laminated because

- To minimize the eddy current loss we increase the resistance in the path of eddy current by laminating it.
- eddy current losses are directly proportional to area of armature or more precisely the path of the motion.
- in laminated armature the eddy current losses are reduces to very less or 0 quantity. thats why armature of DC machines is laminated.

Experiment No. 9 Date :	Demo of DC/AC machine & Parts

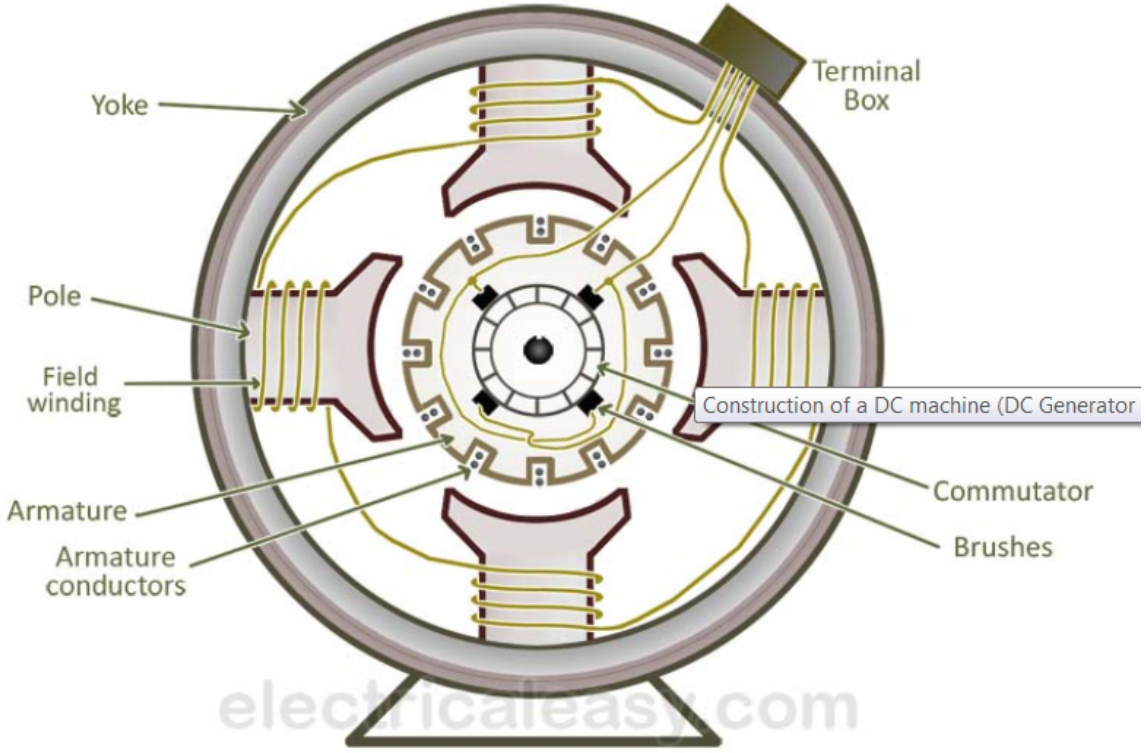
Aim : To know the construction of practical DC, AC machines and identify the parts

DC Generator.

A dc generator is an electrical machine which converts mechanical energy into direct current electricity. This energy conversion is based on the principle of production of dynamically induced emf. This article outlines basic construction and working of a DC generator.

Construction of a DC Machine:

Note: A DC generator can be used as a DC motor without any constructional changes and vice versa is also possible. Thus, a DC generator or a DC motor can be broadly termed as a DC machine. These basic constructional details are also valid for the construction of a DC motor. Hence, let's call this point as construction of a DC machine instead of just 'construction of a dc generator'.



Armature core (rotor)

The above figure shows constructional details of a simple **4-pole DC machine**. A DC machine consists of two basic parts; stator and rotor. Basic constructional parts of a DC machine are described below.

1. **Yoke:** The outer frame of a dc machine is called as yoke. It is made up of cast iron or steel. It not only provides mechanical strength to the whole assembly but also carries the magnetic flux produced by the field winding.

2. **Poles and pole shoes:** Poles are joined to the yoke with the help of bolts or welding. They carry field winding and pole shoes are fastened to them. Pole shoes serve two purposes; (i) they support field coils and (ii) spread out the flux in air gap uniformly.
3. **Field winding:** They are usually made of copper. Field coils are former wound and placed on each pole and are connected in series. They are wound in such a way that, when energized, they form alternate North and South poles
4. **Armature core:** Armature core is the rotor of a dc machine. It is cylindrical in shape with slots to carry armature winding. The armature is built up of thin laminated circular steel disks for reducing eddy current losses. It may be provided with air ducts for the axial air flow for cooling purposes. Armature is keyed to the shaft.
5. Armature winding**:** It is usually a former wound copper coil which rests in armature slots. The armature conductors are insulated from each other and also from the armature core. Armature winding can be wound by one of the two methods; lap winding or wave winding. Double layer lap or wave windings are generally used. A double layer winding means that each armature slot will carry two different coils.
6. **Commutator and brushes:** Physical connection to the armature winding is made through a commutator-brush arrangement. The function of a commutator, in a dc generator, is to collect the current generated in armature conductors. Whereas, in case of a dc motor, commutator helps in providing current to the armature conductors. A commutator consists of a set of copper segments which are insulated from each other. The number of segments is equal to the number of armature coils. Each segment is connected to an armature coil and the commutator is keyed to the shaft. Brushes are usually made from carbon or graphite. They rest on commutator segments and slide on the segments when the commutator rotates keeping the physical contact to collect or supply the current.

Commutator

CONSTRUCTION OF AC MACHINES (THREE PHASE INDUCTION MOTOR)

The three phase induction motor is the most widely used electrical motor. Almost 80% of the mechanical power used by industries is provided by three phase induction motors because of its simple and rugged construction, low cost, good operating characteristics, the absence of commutator and good speed regulation. In three phase induction motor, the power is

transferred from stator to rotor winding through induction. The induction motor is also called a synchronous motor as it runs at a speed other than the synchronous speed.

Like any other electrical motor induction motor also have two main parts namely rotor and stator.

Stator: As its name indicates stator is a stationary part of induction motor. A stator winding is placed in the stator of induction motor and the three phase supply is given to it.

Rotor: The rotor is a rotating part of induction motor. The rotor is connected to the mechanical load through the shaft.

The rotor of the three phase induction motor are further classified as

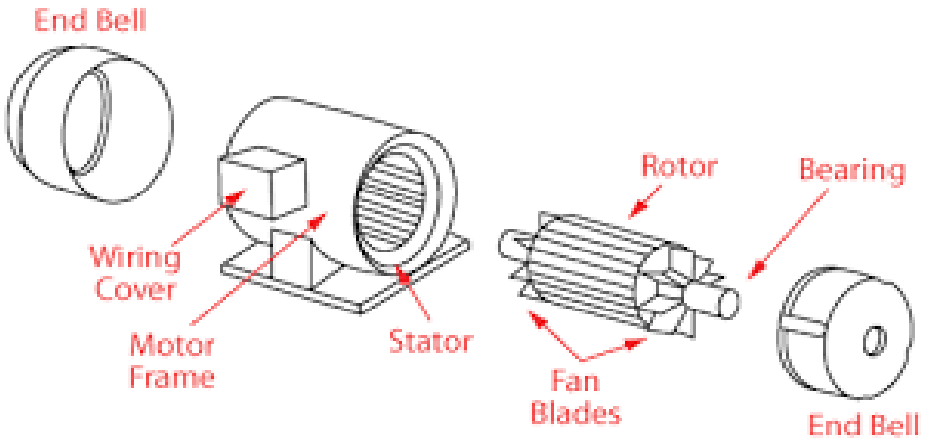
- Squirrel cage rotor,
- Slip ring rotor or wound rotor or phase wound rotor.

STATOR OF THREE PHASE INDUCTION MOTOR

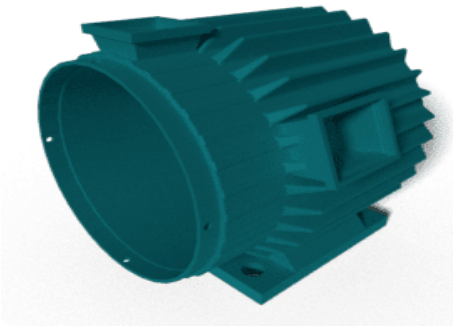
The stator of the three-phase induction motor consists of three main parts :

1. Stator frame,
2. Stator core,
3. Stator winding or field winding.

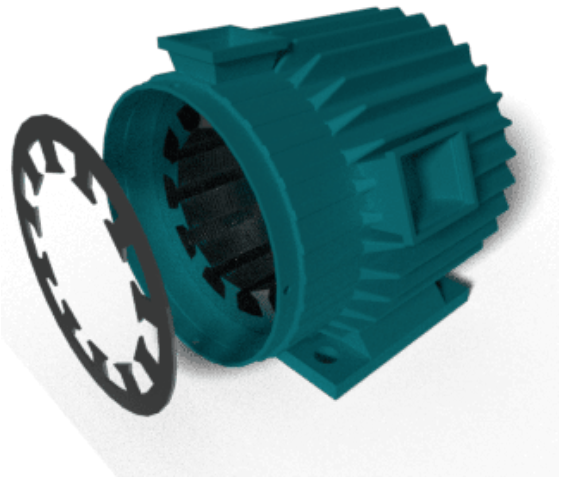
PARTS OF AC MOTOR (3-PHASE INDUCTION MOTOR)



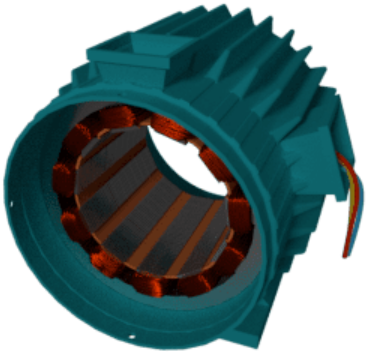
3-Phase Induction Motor



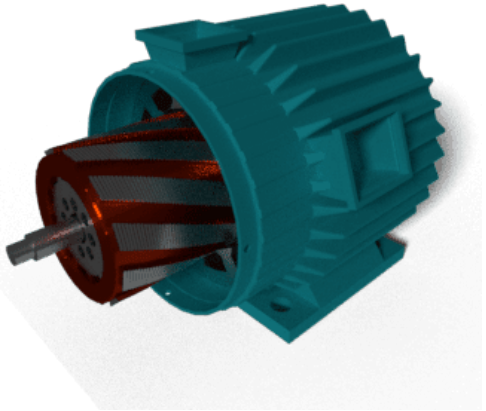
STATOR FRAME



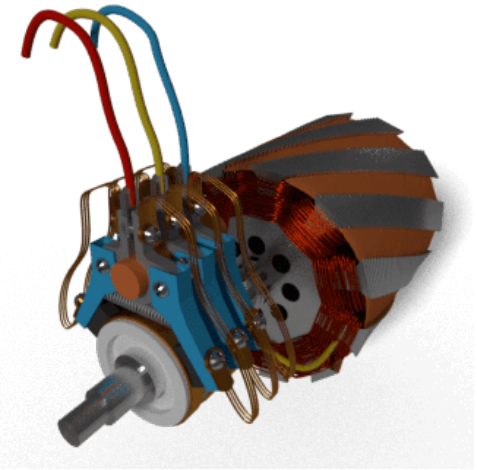
STATOR CORE



STATOR WINDING OR FIELD WINDING



SQUIRREL CAGE THREE PHASE INDUCTION MOTOR



SLIP RING OR WOUND ROTOR THREE PHASE INDUCTION MOTOR

POST-LAB QUESTIONS

1. Why we need starter for machines?

Ans Starters are used to protect DC motors from damage that can be caused by very high current and torque during startup. They do this by providing external resistance to the motor, which is connected in series to the motor's armature winding and restricts the current to an acceptable level.

2. Name any two domestic electrical machines with name plate details.

Ans Two domestic electrical machines with name plate details are:-

- washing machine
- fan

3. Difference between 3-phase squirrel cage and slip-ring induction motor?

Ans One of the major difference between the slip ring and the squirrel cage motor is that the slip ring motor has an external resistance circuit for controlling the speed of the motor. Whereas in squirrel cage motor, it is not possible to add any external circuit because the bar of the motor is permanently slotted at the end of the ring.

4. What are the various types of rotors used in the alternators?

Ans There are mainly two types of rotors used in construction of alternator:

1. Salient pole type.
2. Cylindrical rotor type.

5. What are the applications of DC motors?

Ans DC series motor is suitable for both high and low power drives, for fixed and variable speed electric drives. This type of motor has simple construction. Also, it is easy for design and maintenance.

Because of its high starting torque, this motor uses in the cheap toys and automotive applications such as,

- Cranes
- Air compressor
- Lifts
- Elevators
- Winching system
- Electric traction
- Hair drier
- Vacuum cleaner and in speed regulation application
- power tools
- Sewing machine
- Electric footing