

DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603 203

Title of Experiment	: <b>5. Demo of DC/AC machine &amp; Parts</b>
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Register Number	: RA2011004010051
Date of Experiment	: 01 <sup>st</sup> June 2021

Sl. No.	Marks Split up	Maximum marks (50)	Marks obtained
1	Pre Lab questions	5	
2	Preparation of observation	15	
3	Execution of experiment	15	
4	Calculation / Evaluation of Result	10	
5	Post Lab questions	5	
<b>Total</b>		<b>50</b>	

Staff Signature

## PRE-LAB QUESTIONS

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

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

### 2. Give the classification of AC machines.

AC machines can be differentiated based on four following criteria.

- Principle of Operation.
  - a. Synchronous
  - b. Induction
- Type of Current.
  - a. Single-phase.
  - b. Three-phase.
- Speed of Operation.
  - a. Variable Speed.
  - b. Constant Speed.
  - c. Adjustable Speed.
- Structural Features.
  - a. Open
  - b. Semi-enclosed.
  - c. Ventilated.
  - d. Pipe-ventilated.
  - e. Riveted frame-eye.

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

Brushes are connected to the lower end of the machine to allow the current flow between the moving parts and stationary wires.

### 4. In a DC machine, rectification process is carried out in order to get unidirectional output (DC). This rectification process is carried out by \_\_\_\_\_

In a DC machine, electronic rectification is not used. Instead they use mechanical rectification with the help of **commutator-brush** assembly.

### 5. Why the armature of DC motor is laminated?

By using laminations, the path of eddy currents is divided into several small loops and hence area of the eddy current loops is minimized.

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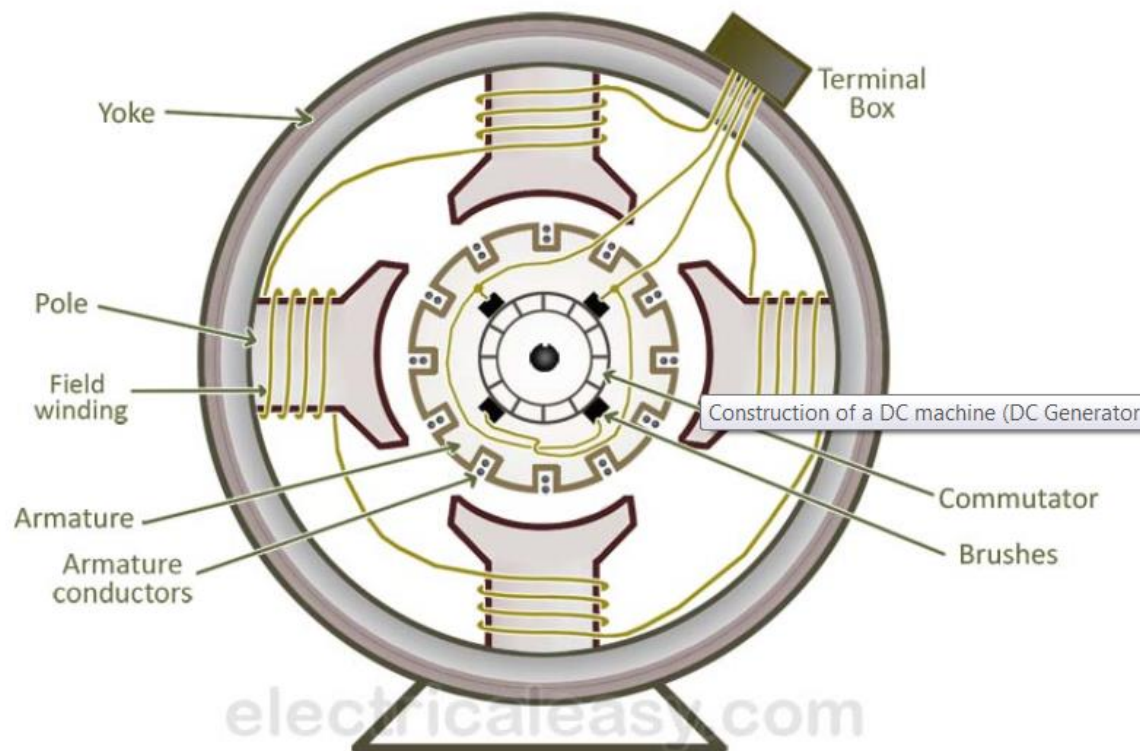
**Aim :** To know the construction of practical DC, AC machines and identify the parts

### 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

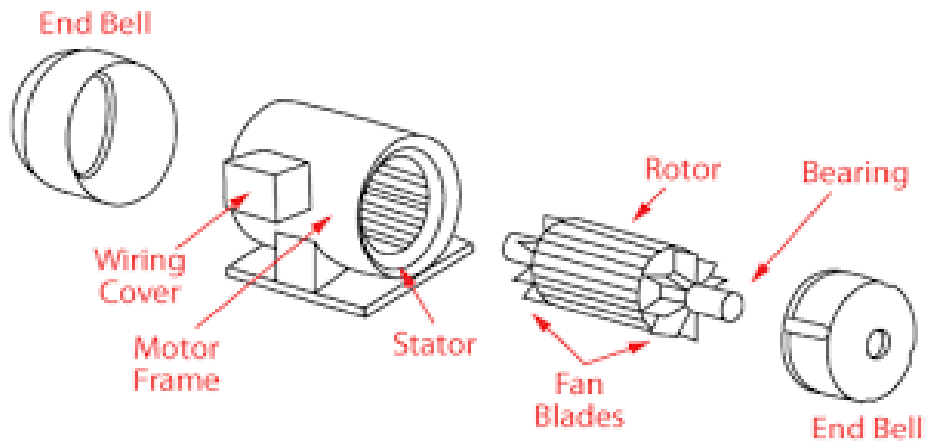
- Squirrel cage rotor,
- Slip ring rotor or wound rotor or phase wound rotor.

### 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.

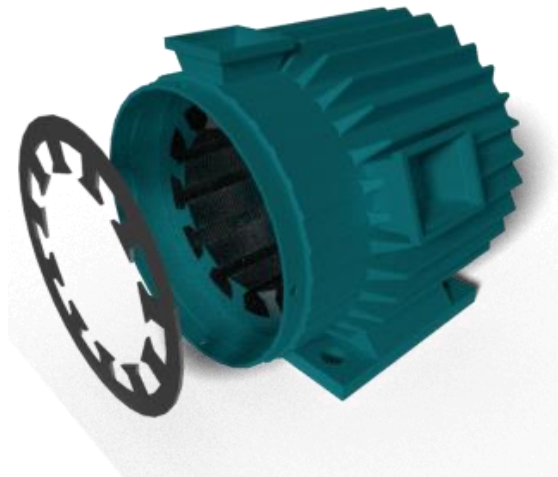
### PARTS OF AC MOTOR (3-PHASE INDUCTION MOTOR)



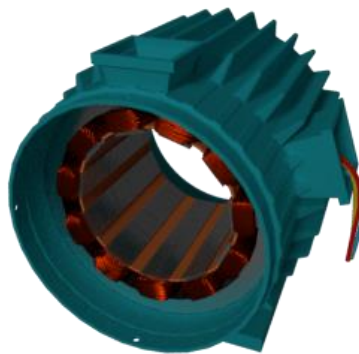
**3-Phase Induction Motor**



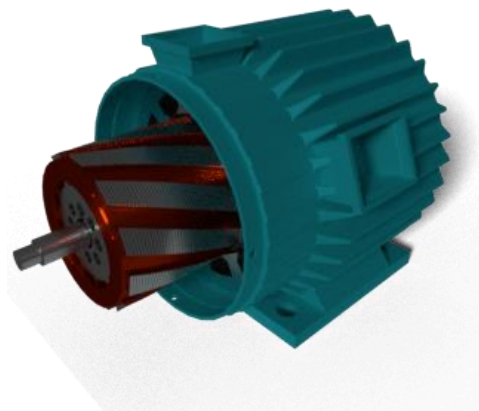
**STATOR FRAME**



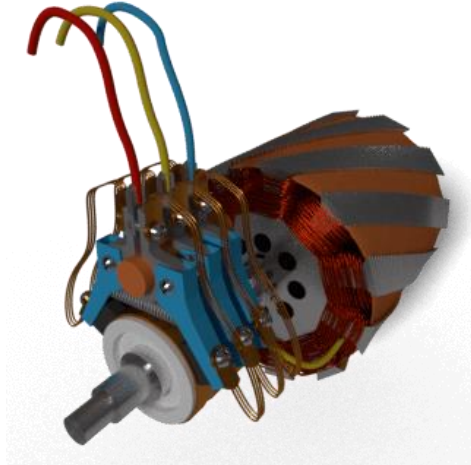
**STATOR CORE**



**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?

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 four the domestic electrical machines with name plate details.

Electric Fans, hair dryer, record player, tape recorder and blowers are some domestic machines where DC motors are used.

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

The slip ring motor has brushes for transferring power whereas the squirrel cage motor is brushless. The copper loss in the phase wound motor is high compared to squirrel cage motor. The efficiency of the slip ring motor is low whereas the squirrel cage motor has high efficiency.

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

There are two types of rotors used in the construction of alternators,

- a. Salient pole type.

It is used as low and medium speed alternator. They are mainly used for low speed turbine such as water power plant.

- b. Smooth cylindrical type.

It is used for steam turbine driven alternator. The rotor of this generator rotates in very high speed.

### 5. What are the applications of DC motors?

Series motors are used in traction systems, cranes, air compressors, vacuum cleaner, etc.

Shunt motors are used in lathe machines, centrifugal pumps, fans, blowers, conveyors, spinning fans.

Compound motors are used in presses, elevators, rolling mills, heavy planners, etc.