SETHU INSTITUTE OF TECHNOLOGY

15UEE504-Electrical Machine Design

Presented by

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15UEE504-Electrical Machine Design

Unit-II

DC Machines:

Output Equations – Main Dimensions -Magnetic circuit calculations – Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Unbalanced Magnetic Pull- Selection of number of poles – Design of Armature – Design of Field winding - Design of commutator and brushes – performance prediction using design values.

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DC Machine :

- The DC machine can be classified into two types namely DC motors as well as DC generators.
- Most of the DC machines are equivalent to AC machines because they include AC currents as well as AC voltages in them.
- The output of the DC machine is DC output because they convert AC voltage to DC voltage.
- The conversion of this mechanism is known as the commutator, thus these machines are also named as commutating machines.
- DC machine is most frequently used for a motor.

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DC Machine :

- The main benefits of this machine include torque regulation as well as easy speed.
- The applications of the DC machine is limited to trains, mills, and mines.
- As examples, underground subway cars, as well as trolleys, may utilize DC motors.
- In the past, automobiles were designed with DC dynamos for charging their batteries.

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DC Machine :

- A DC machine is an electromechanical energy alteration device.
- The working principle of a DC machine is when electric current flows through a coil within a magnetic field, and then the magnetic force generates a torque which rotates the dc motor.
- The DC machines are classified into two types such as DC generator as well as DC motor.

DC Machine :

- 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
- The AC motor is frequently used in the industrial applications for altering electrical energy to mechanical energy.
- However, a DC motor is applicable where the good speed regulation & Sample range of speeds are necessary like in electric-transaction systems.

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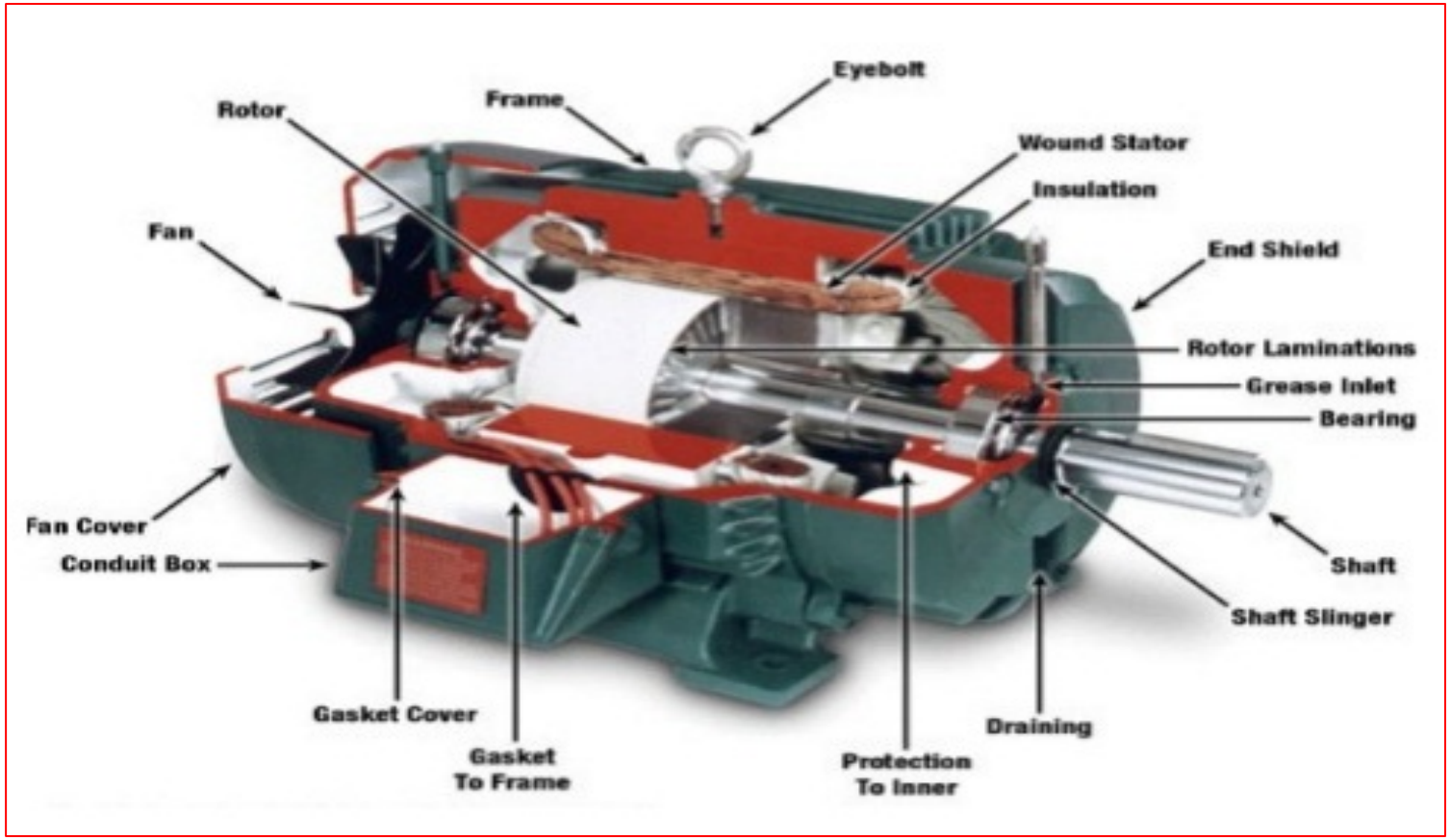
DC Machine :



Construction of DC Machine:

- The construction of DC machine can be done using some of the essential parts like,
  - Yoke
  - Pole core & pole shoes
  - Pole coil & field coil
  - Armature core
  - Armature winding otherwise conductor,
  - Commutator, brushes & bearings

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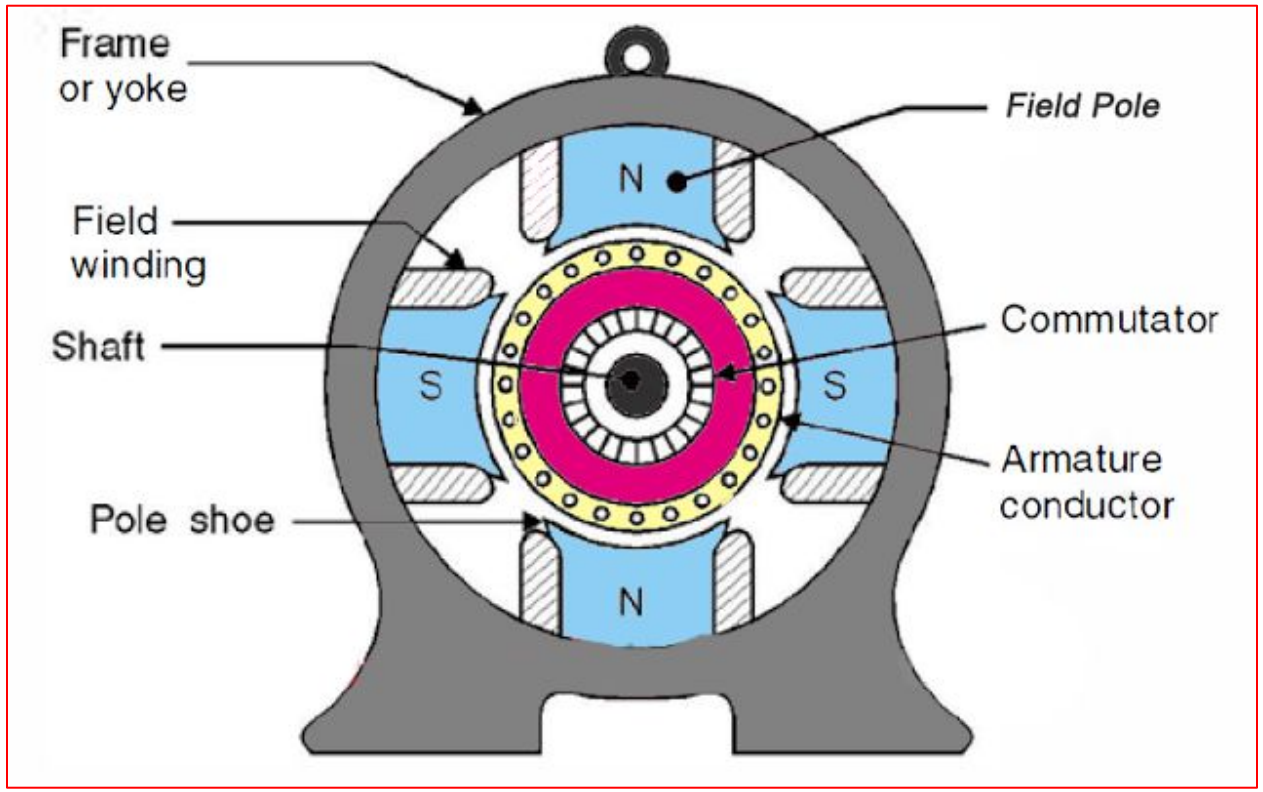
Construction of DC Machine :



Construction of DC Machine :

Yoke

- Another name of a yoke is the frame.
- The main function of the yoke in the machine is to offer mechanical support intended for poles and protects the entire machine from the moisture, dust, etc.
- The materials used in the yoke are designed with cast iron, cast steel otherwise rolled steel.

Construction of DC Machine :

Pole and Pole Core

- The pole of the DC machine is an electromagnet and the field winding is winding among pole.
- Whenever field winding is energized then the pole gives magnetic flux.
- The materials used for this are cast steel, cast iron otherwise pole core.
- It can be built with the annealed steel laminations for reducing the power drop because of the eddy currents.

Construction of DC Machine :

Pole Shoe

- Pole shoe in DC machine is an extensive part as well as enlarge the region of the pole.
- Because of this region, flux can be spread out within the air-gap as well as extra flux can be passed through the air space toward armature.
- The materials used to build pole shoe is cast iron otherwise cast steed, and also used annealed steel lamination to reduce the loss of power because of eddy currents.

Construction of DC Machine :

Field Windings

- In this, the windings are wounded in the region of pole core & named as field coil.
- Whenever current is supplied through field winding then it electromagnetics the poles which generate required flux.
- The material used for field windings is copper.

Construction of DC Machine :

Armature Core

- Armature core includes the huge number of slots within its edge.
- Armature conductor is located in these slots.
- It provides the low-reluctance path toward the flux generated with field winding.
- The materials used in this core are permeability low-reluctance materials like iron otherwise cast.
- The lamination is used to decrease the loss because of the eddy current.

Construction of DC Machine :

Armature Winding

- The armature winding can be formed by interconnecting the armature conductor.
- Whenever an armature winding is turned with the help of prime mover then the voltage, as well as magnetic flux, gets induced within it.
- This winding is allied to an exterior circuit.
- The materials used for this winding are conducting material like copper.

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Construction of DC Machine :

Commutator

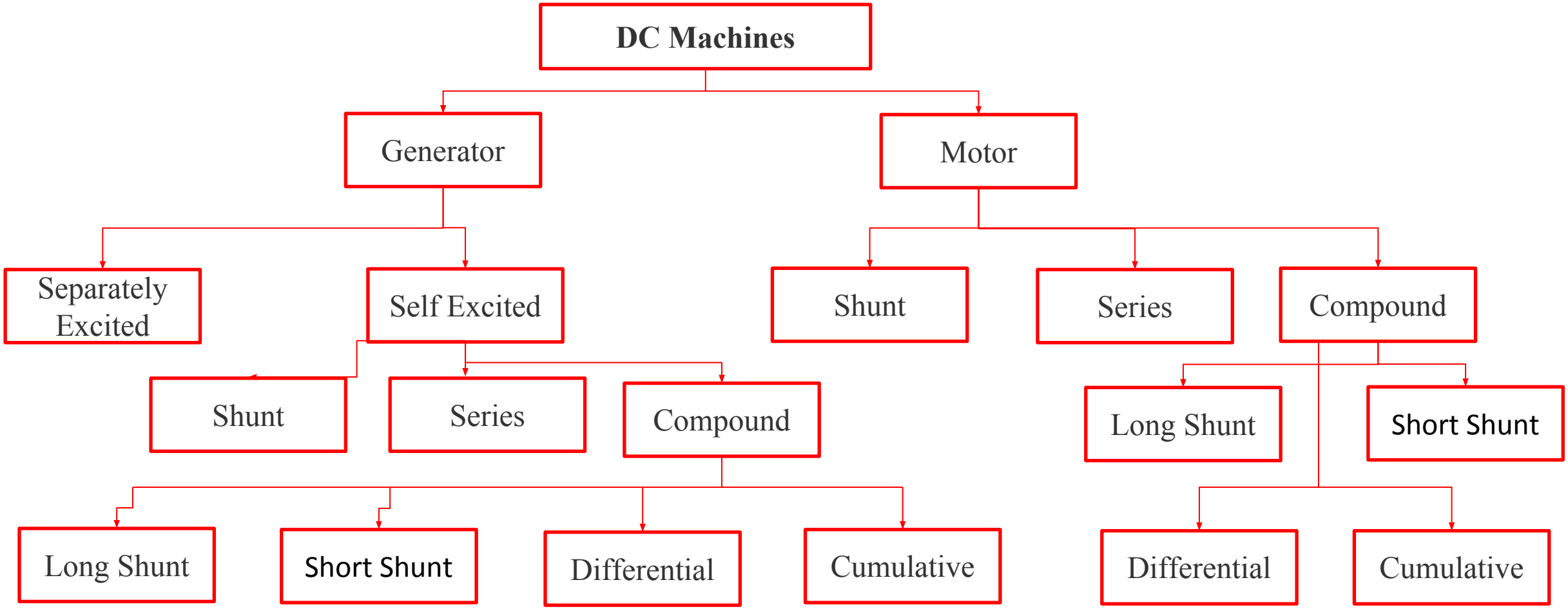
- The main function of the commutator in the DC machine is to collect the current from the armature conductor as well as supplies the current to the load using brushes.
- And also provides uni-directional torque for DC-motor.
- The commutator can be built with a huge number of segments in the edge form of hard drawn copper.
- The Segments in the commutator are protected from thin mica layer.

Construction of DC Machine :

Brushes

- Brushes in the DC machine gather the current from commutator and supplies it to exterior load.
- Brushes wear with time to inspect frequently.
- The materials used in brushes are graphite otherwise carbon which is in rectangular form

Types of DC Machines



Thank you