UNIT-III

Fundamentals of Electrical Machines

Lecture 20

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Previous Lecture topics

- Speed Equation

$$N \propto (V - I_a R_a) / \phi$$

- Speed Control Methods

- Starters
- Need of Starters

Revision Quiz (Poll 1)

The reason for using starter while starting of DC motor is

a) To restrict armature current as there is no back E.M.F at starting
b) Motors are not self-starting
c) Restrict starting torque
d) None of the above

Reversal of Direction of Rotation:

- The direction of the magnetic flux in the air gap depends on the direction of the field current.
- And the direction of the force exerted on the armature winding depends on the direction of flux and the direction of armature current.
- Thus in order to reverse the direction of dc motor, we have to reverse the direction of force.
- This can be achieved either by changing the terminals of the armature or the terminals of the field winding.

Specifications of DC Motor

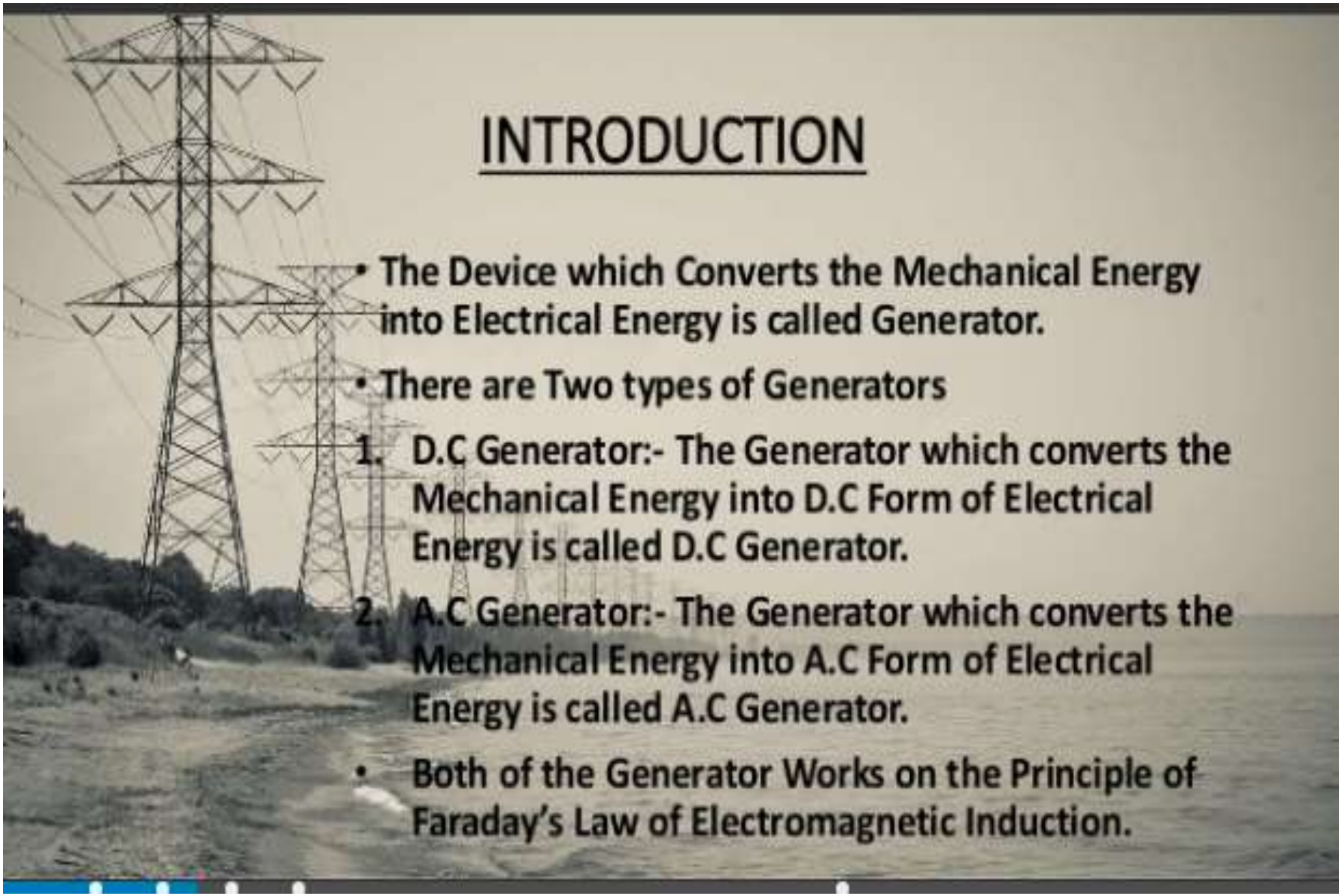
- Some of important specifications of a DC motor:

1. Output power in horse power(H.P.)
2. Rated voltage
3. Type of field winding
4. Excitation voltage
5. Base speed in RPM
6. Current
7. Frame size
8. Rating

Typical specifications of DC series motor

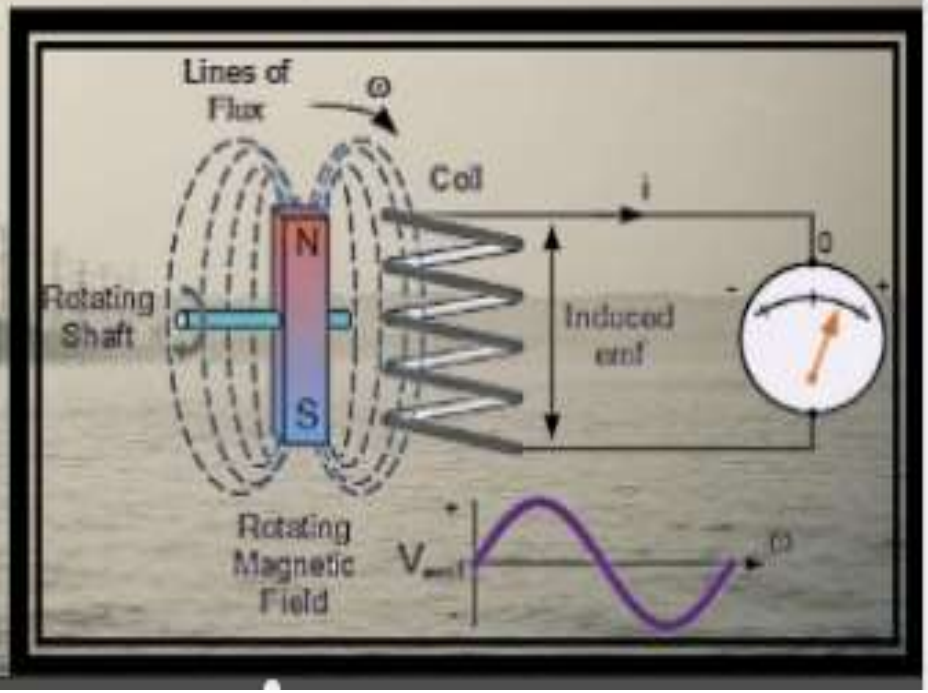
Sr. No.	Specifications/Rating	Value
1.	Output power in horse power	3HP
2.	Rated voltage	230V
3.	Type of field winding	Series
4.	Excitation voltage	230V
5.	Insulation	B
6.	Base speed	1000RPM
7.	Current	11Amp
8.	Frame size	132
9.	Rating	Continous
10.	S.R.Number	840858

DC Generators



PRINCIPLE OF OPERATION

- In 1831, Michael Faraday, an English physicist gave one of the most basic laws of electromagnetism called **Faraday's law of electromagnetic induction**.

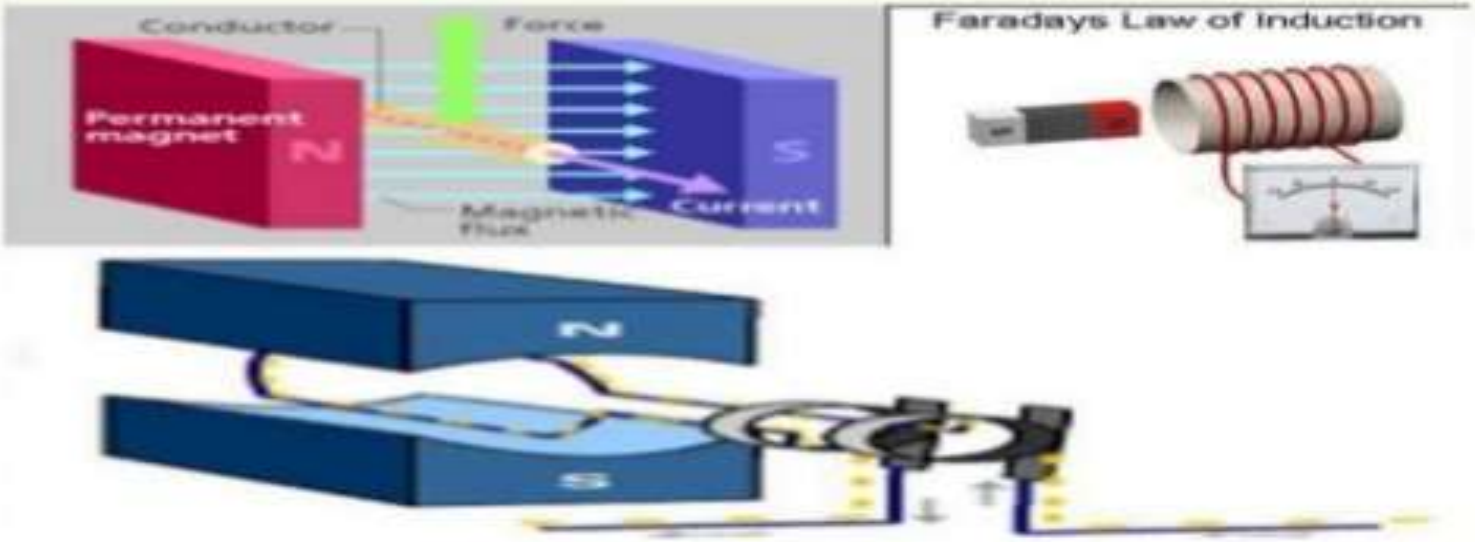


PRINCIPLE OF OPERATION

- **FARADAYS LAWS**

First law : Whenever a conductor cuts magnetic flux, an e.m.f is induced in that conductor.

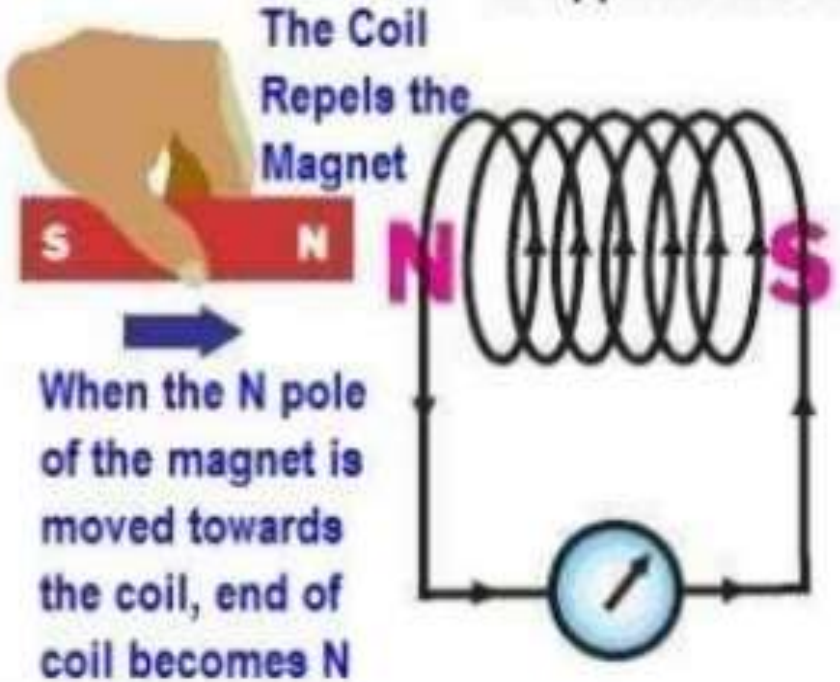
Second law : The magnitude of the induced e.m.f is equal to the rate of change of flux linkages.



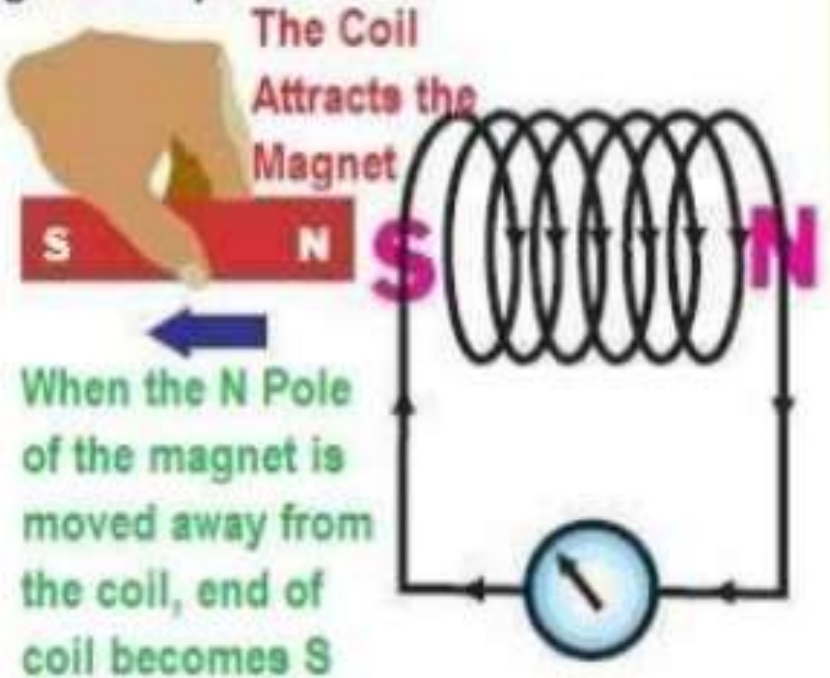
$$e = -\frac{d\Phi}{dt}$$

PRINCIPLE OF OPERATION

Len'z Law An Induced Current always flows in a direction such that it Opposes the change which produced it.

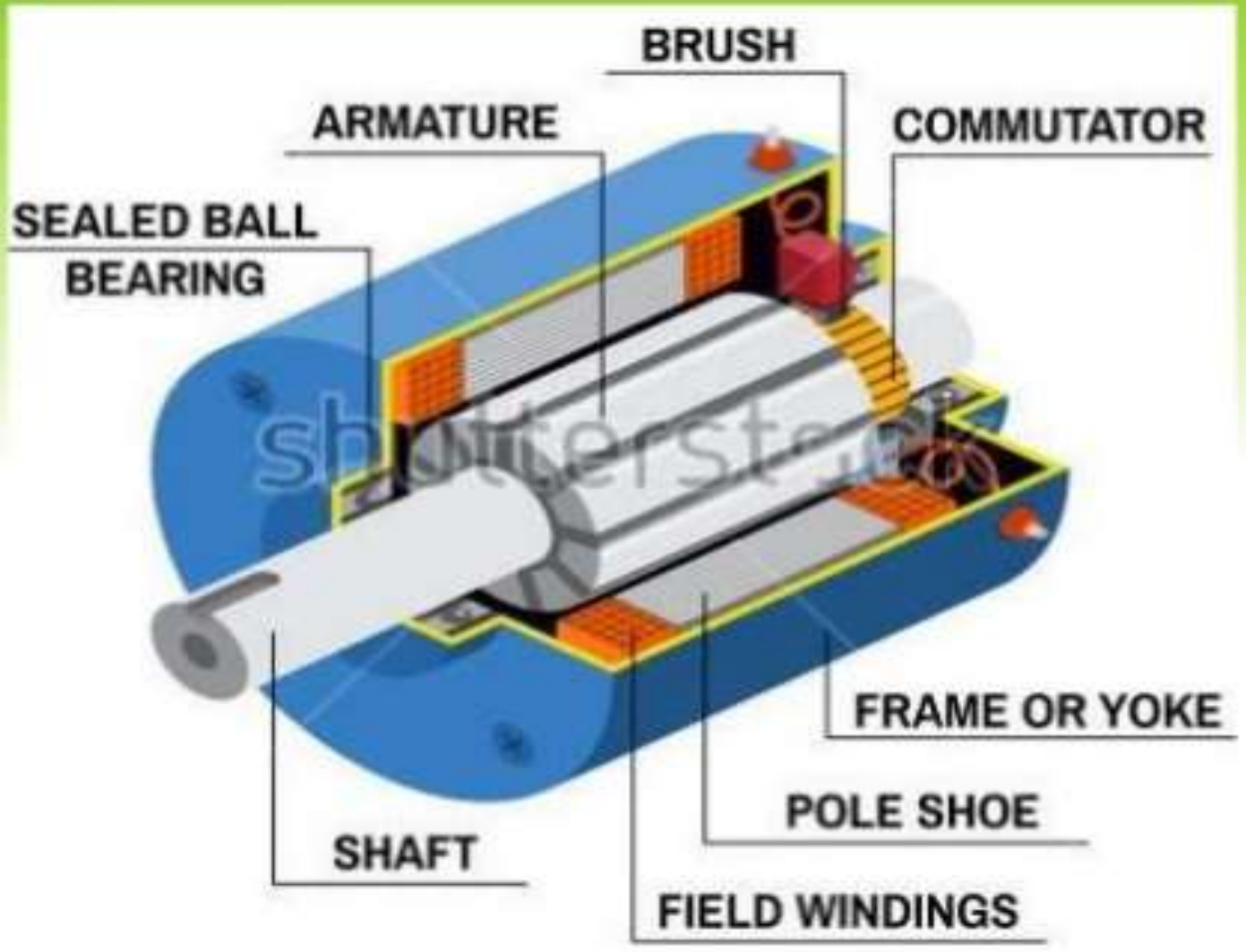


When the N pole of the magnet is moved towards the coil, end of coil becomes N Pole.

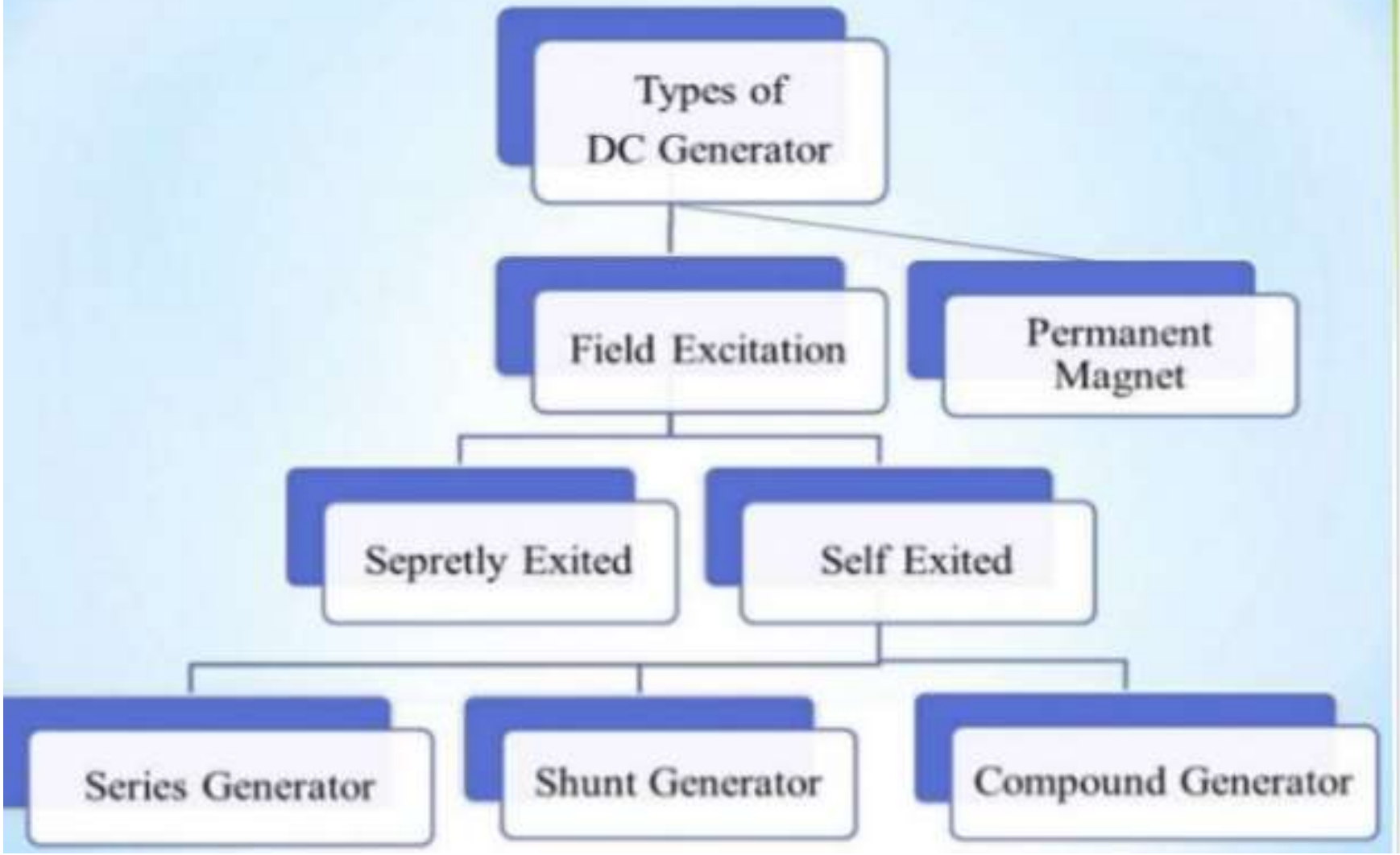


When the N Pole of the magnet is moved away from the coil, end of coil becomes S pole.

DC GENERATOR

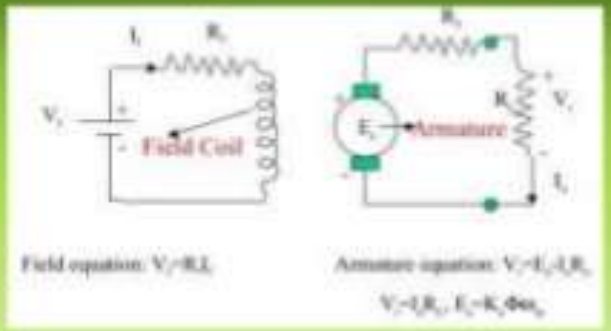


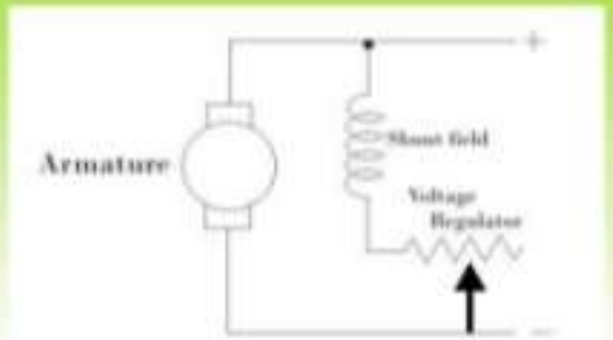
TYPES OF DC GENERATOR.



ACCORDING TO THE WAY OF FIELD EXCITATION

1. **Saparately Excited DC Generator**
   - The field winding is excited from dedicated DC supply i.e : Battery

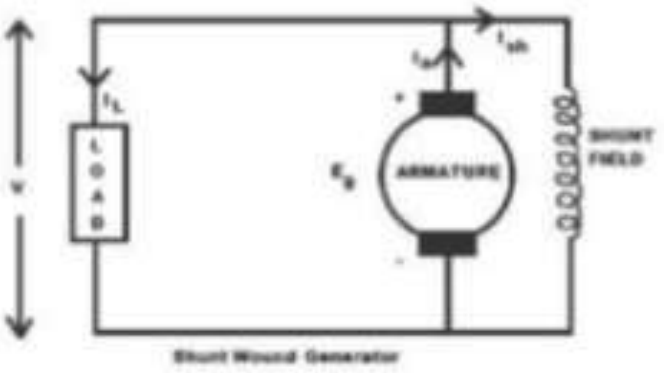




2. **Self Excited DC Generator**
   - The field winding is excited from the armature. No need separate DC supply.

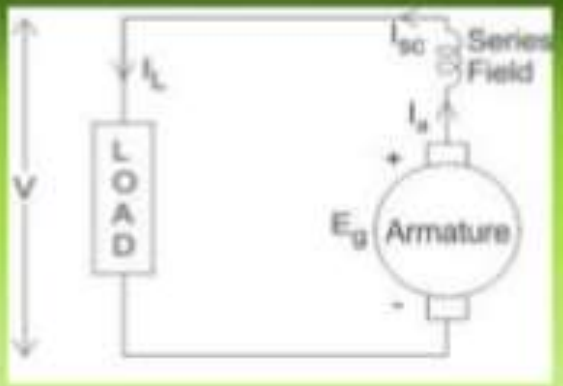
ACCORDING TO THE CONNECTION OF FIELD WINDING WITH RESPECT TO ARMATURE WINDING

1. **Shunt Generator**
   - The field winding is connected in parallel with armature winding
   - Application : Lighning load, Battery charging, Use for giving excitation to the alternator



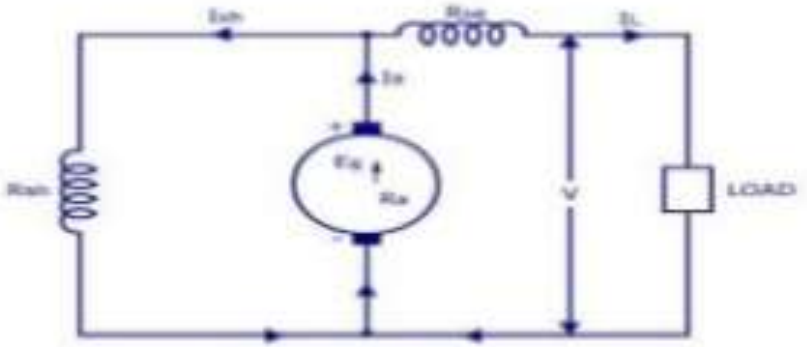
2. Series Generator

- Field winding is connected in series with the armature.
- Application : For arc lamp, As constant current generator, As booster on DC generator

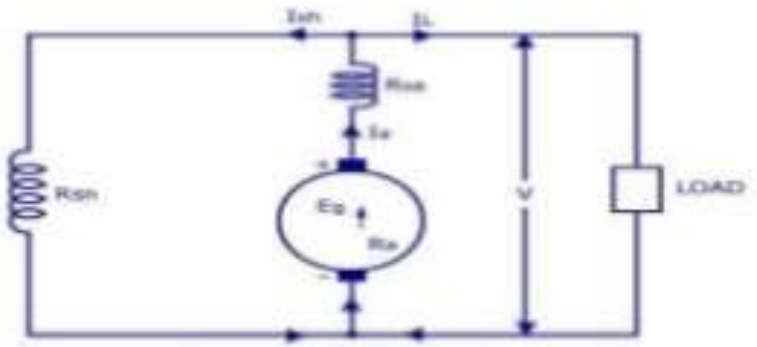


3. Compound Generator

- Both series and shunt winding are used to get combined characteristic of two types of generator.
- Application : Use for driving a motor, for small distance operation (power supply for hotel, office & home)



Short Shunt Compound
(a)



Long Shunt Compound
(b)

- Short Shunt : Only shunt field winding is in parallel with armature winding.
- Long Shunt : Shunt field winding is in parallel with both series field & armature winding.

Applications of DC Generator

Shunt Generators:

a. in electro plating

b. for battery recharging

c. as exciters for AC generators.

Series Generators :

A. As boosters

B. As lighting arc lamps

Quick Quiz (Poll 2)

- The armature of DC generator is laminated to

a) Reduce Hysteresis loss
b) Insulate the Core
c) Reduce eddy current loss
d) Provide air cooling passage

Quick Quiz (Poll 3)

- The thickness of lamination in D.C machine is approx

a) 5 mm
b) 0.5 mm
c) 0.005 mm
d) 5 mm