



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE407 ELECTRICAL MACHINES AND DRIVES

II YEAR / 04 SEMESTER MECH

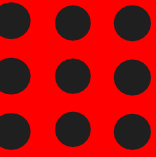
Unit 2 – ELECTRICAL MOTORS

Universal Motor



What Is a Universal Motor?

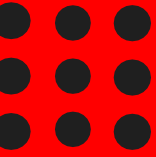
- A universal motor is a special type of motor that runs on both AC and DC power supplies.
- Universal motors are series-wound (the armature and field windings are in series).
- The series connection allows them to generate high torque; hence the universal motors are generally built into the device they are meant to drive.
- Most of the universal motors are meant to operate at speeds as high as 3500 RPM.
- These motors run at a higher speed on DC supply than they run on AC supply of the same voltage.
- This is due to the reactance voltage drop that is present only in AC and not in DC.





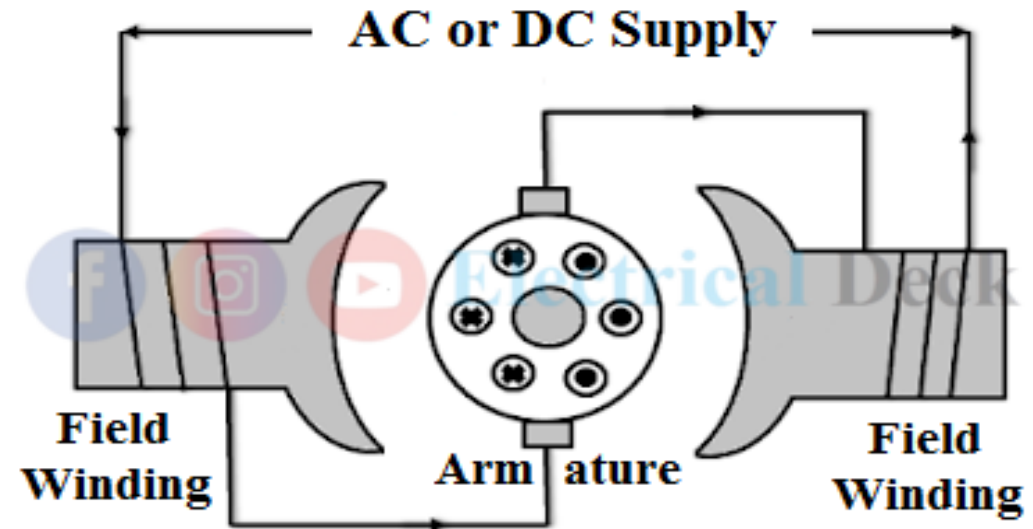
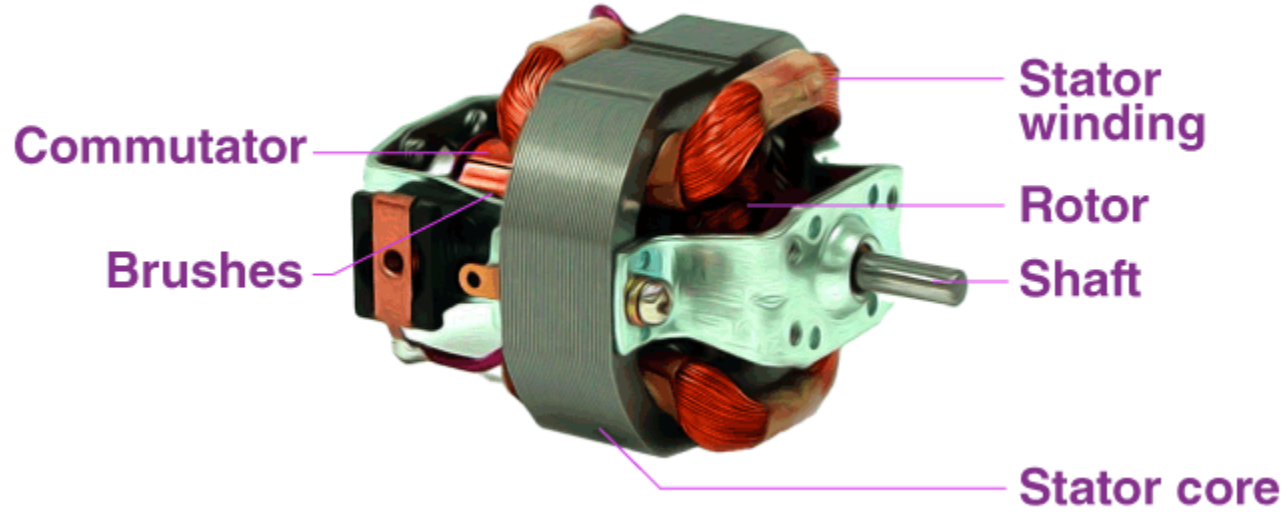
How does a Universal Motor run on both AC and DC supply?

- The construction of a universal motor is similar to that of a series-wound DC motor.
- A universal motor incorporates some modification that allows it to operate either on AC or DC supply.





Construction of a Universal Motor



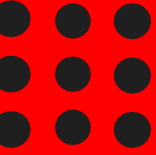


A universal motor consists of a stator on which the field poles are mounted.

- Field coils are wound around the field poles. Both the stator field circuit and armature of a universal motor are laminated.
- Laminations are necessary to reduce the eddy currents that are produced while operating on AC power.
- The universal motor's rotary armature is made of straight or skewed slots on which the [commutator](#) and brushes rest.
- The commutation on AC is poorer than that for DC because of the current induced in the armature coils. For this reason, the brushes used have high resistance.



Operation of Universal Motor



When fed with a DC supply

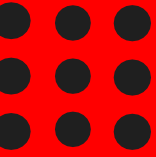
- When the universal motor is fed with a DC supply, it works as a DC series motor.
- In this case, when the current flows in the field winding, it produces an electromagnetic field.
- The same current also flows in the armature conductors. When a current-carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force.
- This mechanical force causes the rotor to rotate. Fleming's Left-hand rule gives us the direction of this force.





When fed with an AC supply

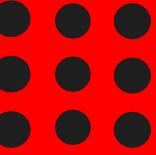
- A unidirectional torque is produced when the universal motor is supplied with AC power.
- This is because the armature winding and the field winding are connected in series and are in the same phase.
- Therefore, whenever the polarity of the AC changes, the direction of the current in the armature and the field winding changes simultaneously.
- The direction of the magnetic field and the direction of armature current reverse, so that the direction of force experienced by armature conductors remains the same.
- Thus, regardless of AC or DC supply, universal motors work on the same principle that DC series motors work on.





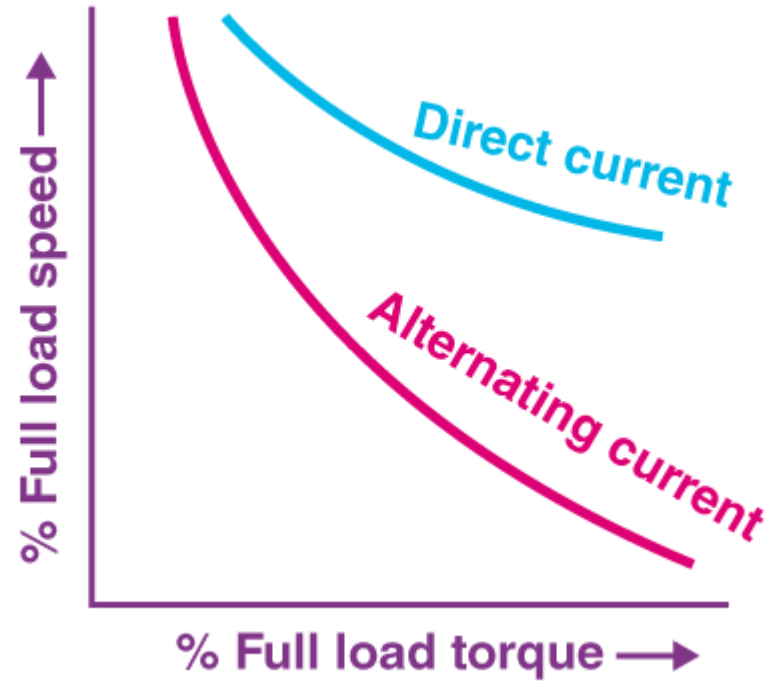
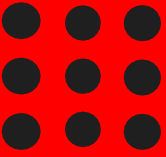
Properties of Universal Motors

- They run at high speed.
- They have high starting torque.
- Compact size and are lightweight.
- They are noisy because of the commutator and brushes.





Mechanical Characteristics





Applications of Universal Motor

- Universal Motors are used in table fans, hairdryers and grinders.
- They are used in portable drill machines.
- They are used in polishers, blowers and kitchen appliances.

