



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



COIMBATORE-35

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 23EEB210 / Electrical Machines and Drives

II YEAR / IV SEMESTER

Unit II – ELECTRICAL MOTORS

Topic : Universal Motor



UNIVERSAL MOTOR

- It is a Special electrical motor which is designed to operate with a single-phase AC source as well as a DC source of supply voltages.
- Generally, it is series wound i.e., armature and field winding are in series to produce high starting torque.
- It is designed to operate at higher speed operation, exceeding 3500rpm.
- It is mainly designed for DC operation if works on single-phase AC supply suffers from the following drawbacks:
 - The efficiency becomes low because of hysteresis and eddy current losses.
 - The power factor is low due to the large reactance of the field and the armature windings.
 - The sparking at the brushes is in excess.



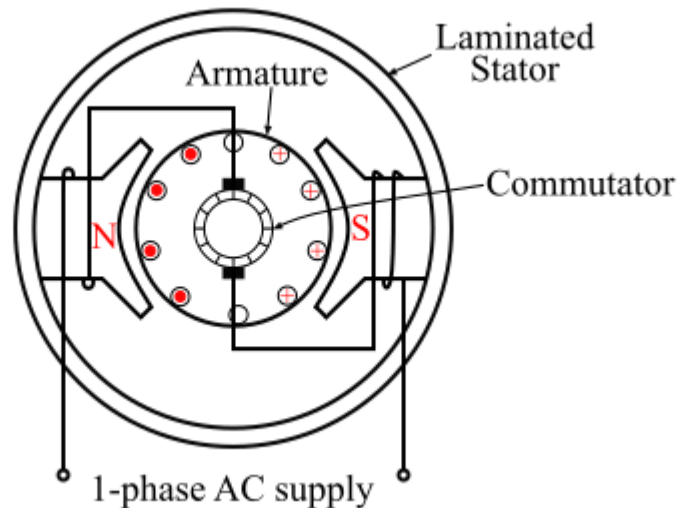
UNIVERSAL MOTOR

- Some changes must be made in a DC series motor so that it may operate satisfactorily on AC supply. The changes are given as follows
 - The entire magnetic circuit is constructed of a material having low hysteresis loss. It is laminated to reduce the eddy current loss.
 - The series field winding must have small number of turns. The area of field pole is increased so that the magnetic flux density is decreased. This decreases the core loss and the reactive voltage drop.
 - In order to obtain the required torque with the low magnetic flux, the number of armature conductors is increased.
 - A compensating winding is used to reduce the effect of armature reaction, thereby improving the commutation and reducing the armature reaction.



CONSTRUCTION

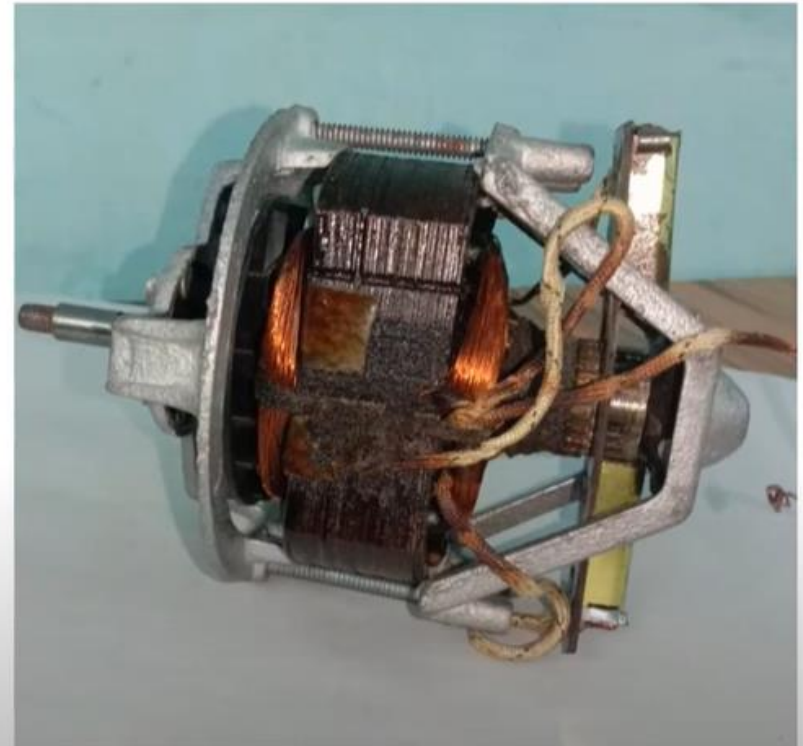
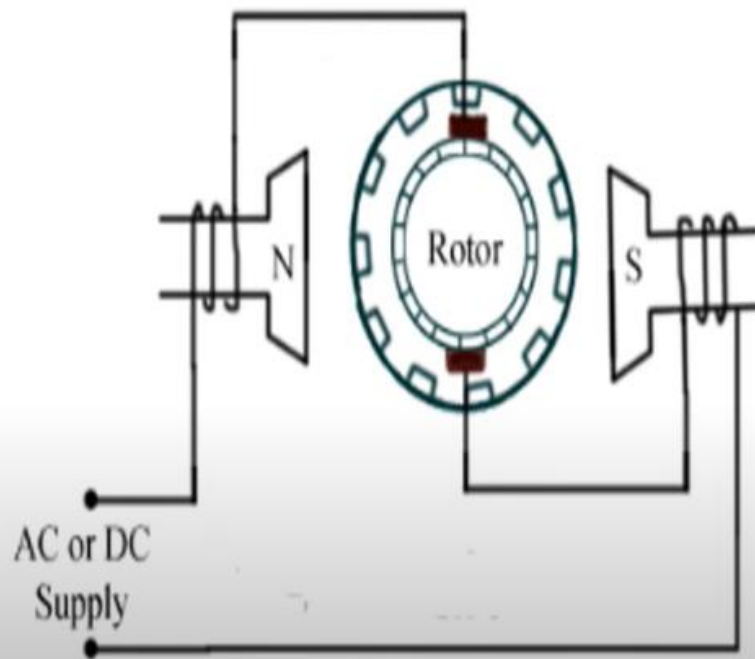
- It consists of a laminated stator and a rotor or armature. The field poles are bolted to the inner periphery of the stator.
- The field winding and the armature windings are connected series and fed by a single-phase AC source.
- A Commutator is mounted on the rotor shaft of the motor and brushes ride on the Commutator.





UNIVERSAL MOTOR

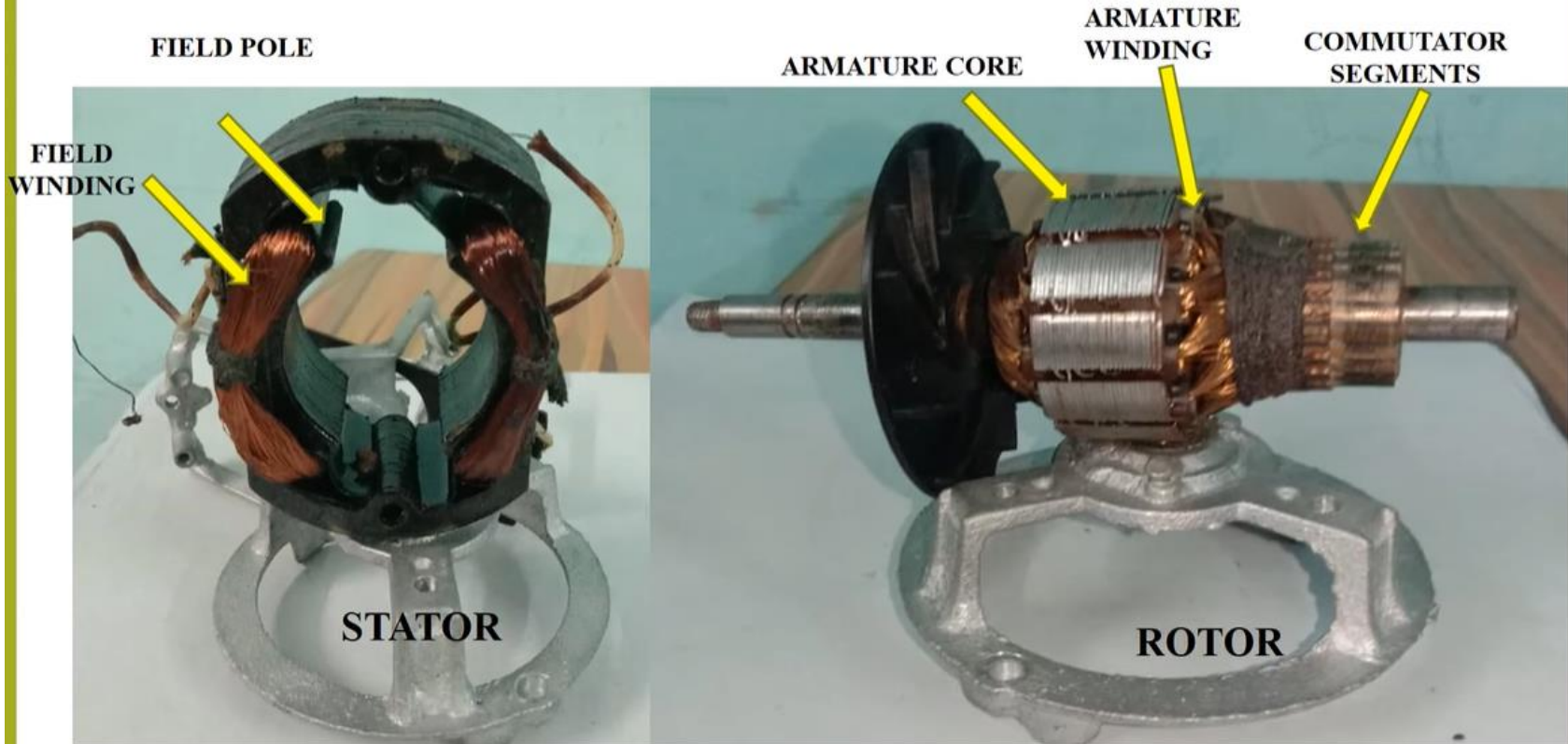
CONSTRUCTION





UNIVERSAL MOTOR

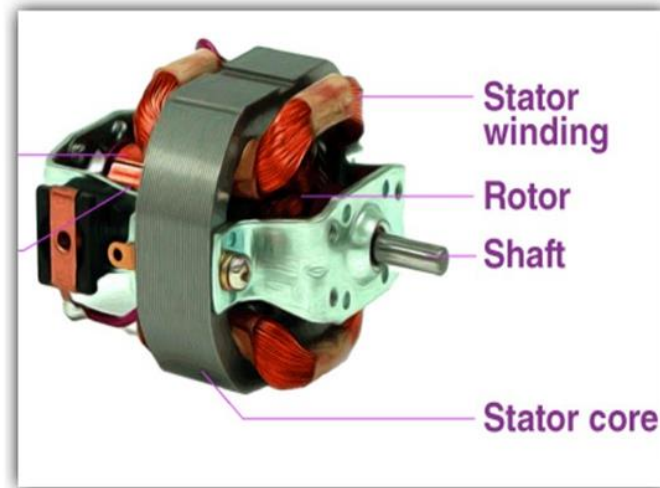
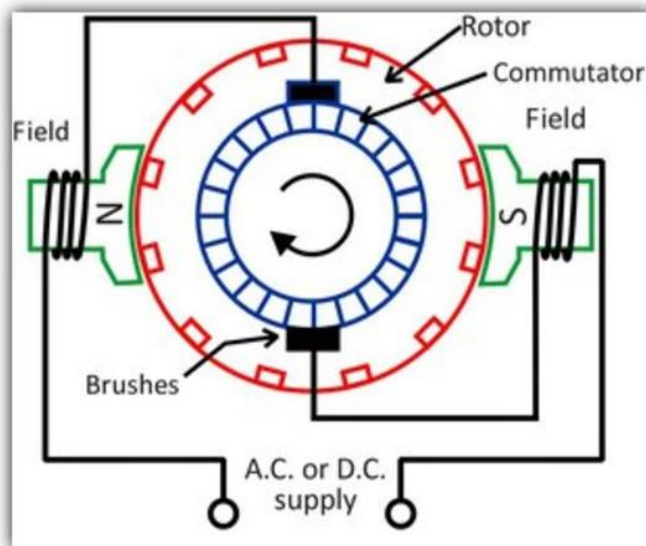
MACHINE PARTS





WORKING

- When the motor is connected to a single-phase AC supply, the same alternating current flows through the field and the armature winding.
- The series field winding of the motor produces an alternating flux that reacts with the magnetic field produced by the currents in the armature winding to produce a torque.
- Since the currents through the series field winding and the armature winding reverse simultaneously, the produced torque is unidirectional.

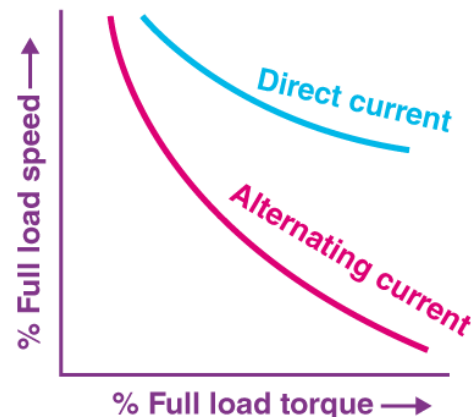




CHARACTERISTICS

- Universal motors have high starting torque.
- The speed of the universal motors increases to a high value with a decrease in the load.
- In very small universal motors, the no-load losses are usually large enough that limit the speed of the motor to a definite value ranging from 1500 to 20000 RPM.
- The power factor of universal motor at full load is about 90%. However, the power factor at starting or overloading is low.

Speed Load Characteristics of Universal Motor





APPLICATIONS

- Used in Portable drill machines.
- Used in hairdryers, grinders, and table fans.
- Used in blowers, polishers, and kitchen appliances.
- Used in Electric shavers, Sewing machines, High speed vacuum cleaners, Machine tools.



VIDEOS



Working—

<https://www.youtube.com/watch?v=0PDRJKz-mqE&t=22s>