



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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19EET101 / BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING I YEAR / I SEMESTER

UNIT-II: ELECTRICAL MACHINES

THREE PHASE INDUCTION MOTOR



TOPIC OUTLINE



- ✓ Construction
- ✓ Working Principle
- ✓ TYPES
- ✓ Applications





Three Phase AC Induction Motor



The three-phase AC induction motor is a rotating electric machine that is designed to operate on a three-phase supply. This 3 phase motor is also called as an asynchronous motor. These AC motors are of two types: squirrel and slip-ring type induction motors. The principle of operation of this motor is based on the production of a rotating magnetic field.

Types :

There are two types of 3-phase induction motor based on the type of rotor used:

Squirrel cage induction motor.

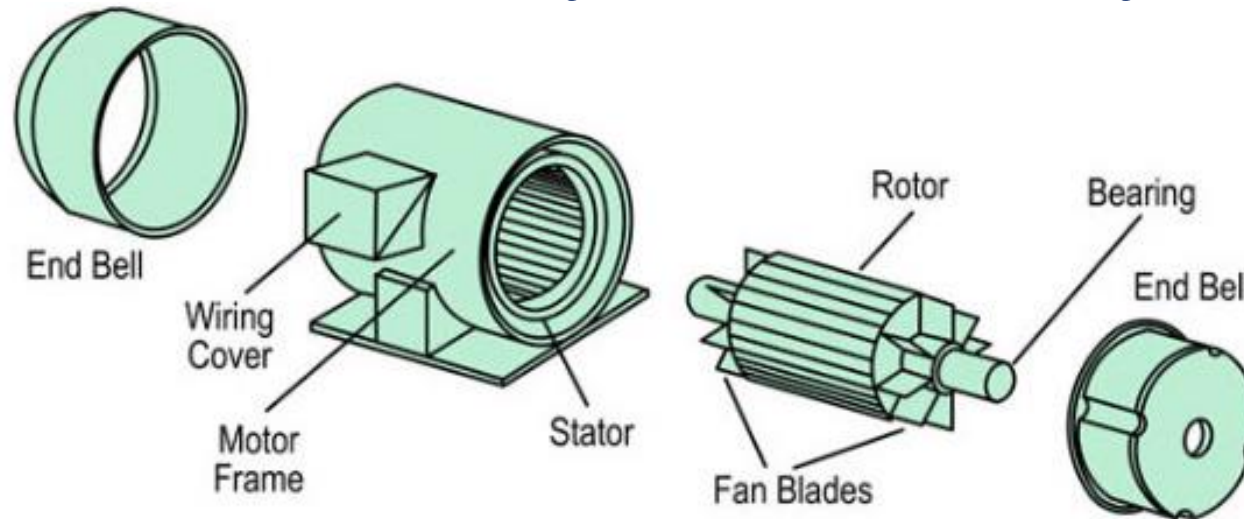
Slip ring induction motor.





3 Phase Induction Motor Construction

These three-phase motors consist of a stator and a rotor and between which no electrical connection exists. These stator and rotors are constructed with the use of high-magnetic core materials in order to reduce hysteresis and eddy current losses.

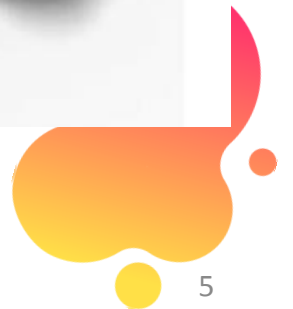
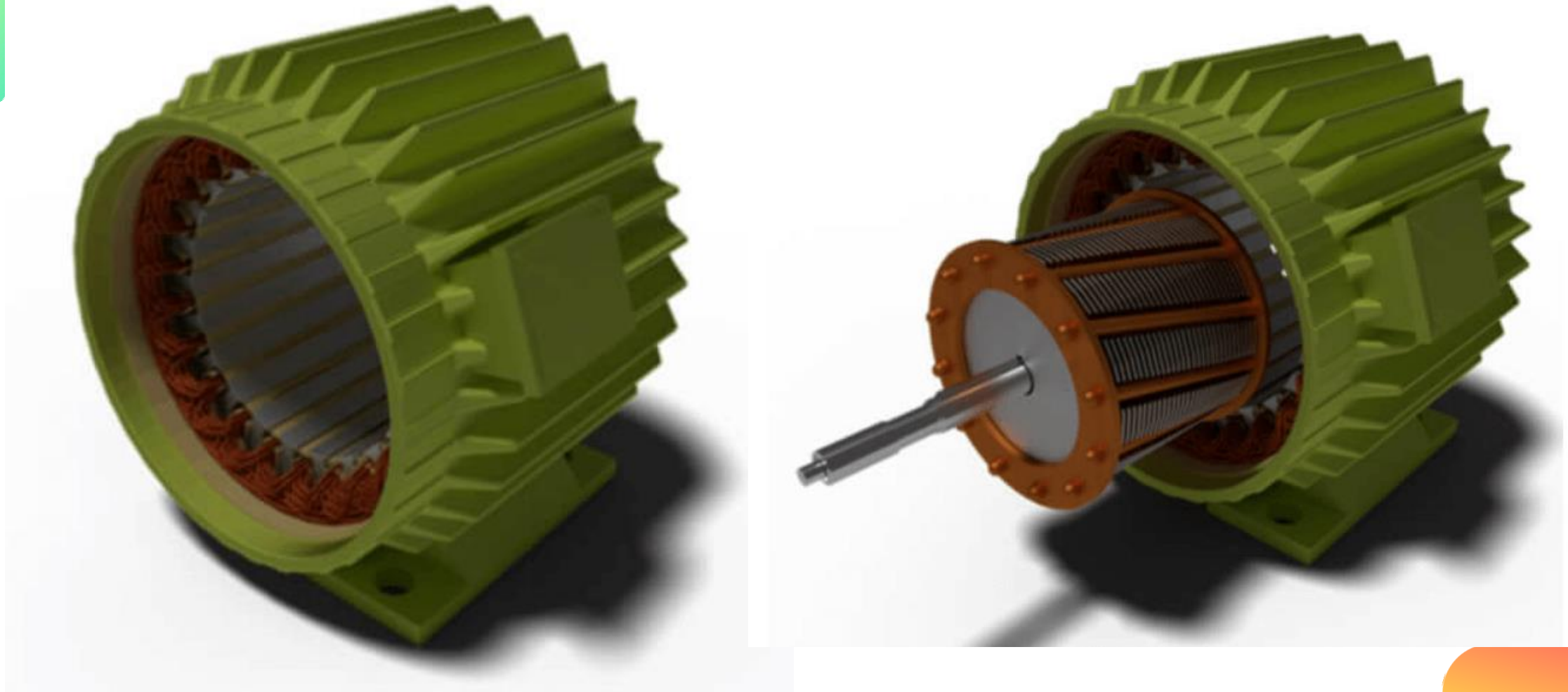


3 Phase Induction Motor Construction





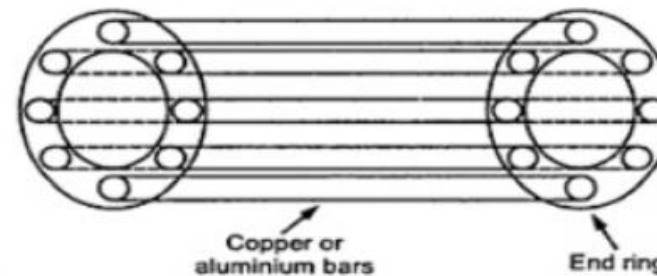
Basic Construction:-



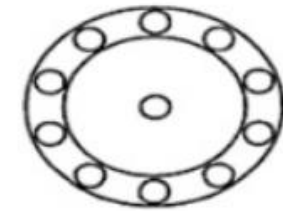


3 Phase Induction Motor Construction

The rotor bars are brazed or electrically welded or bolted to two heavy and stout short circuiting end-rings, thus giving us, what is called a squirrel cage construction



(a) Cage type structure of rotor



(b) Symbolic representation

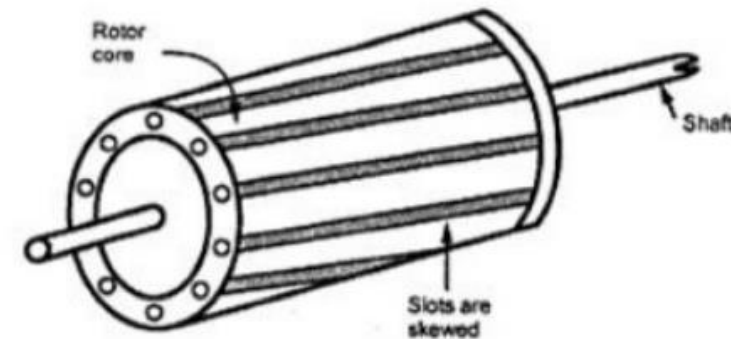


Fig 2.22 Squirrel Cage Rotor





3 Phase Induction Motor Construction

This type of rotor is provided with 3-phase, double-layer, distributed winding consisting of coils are used in alternators.

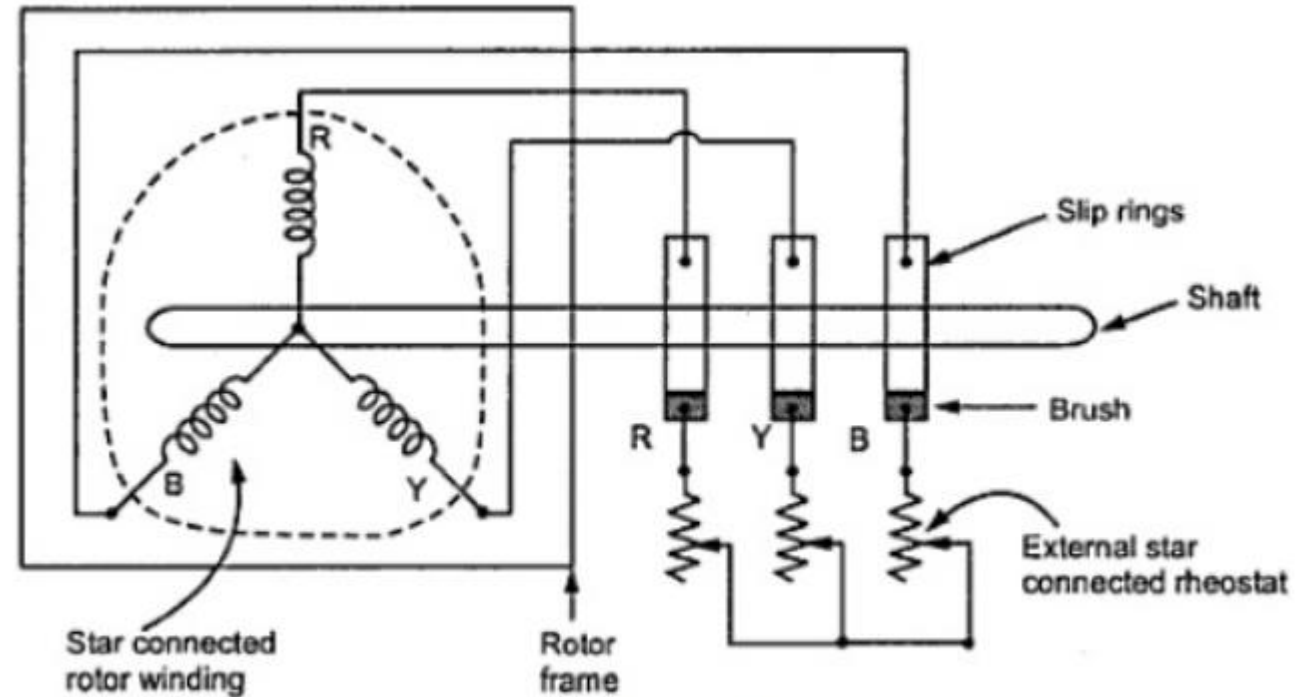


Fig 2.23 Slip ring Rotor





Working principle:



Induction motor works on the principle of electromagnetic induction.

When three phase supply is given to the stator winding, a rotating magnetic field of constant magnetic field is produced.

The speed of rotating magnetic field is synchronous speed, N_s r.p.m.

➤
$$N_s = \frac{120f}{P} = \text{speed of rotating magnetic field}$$

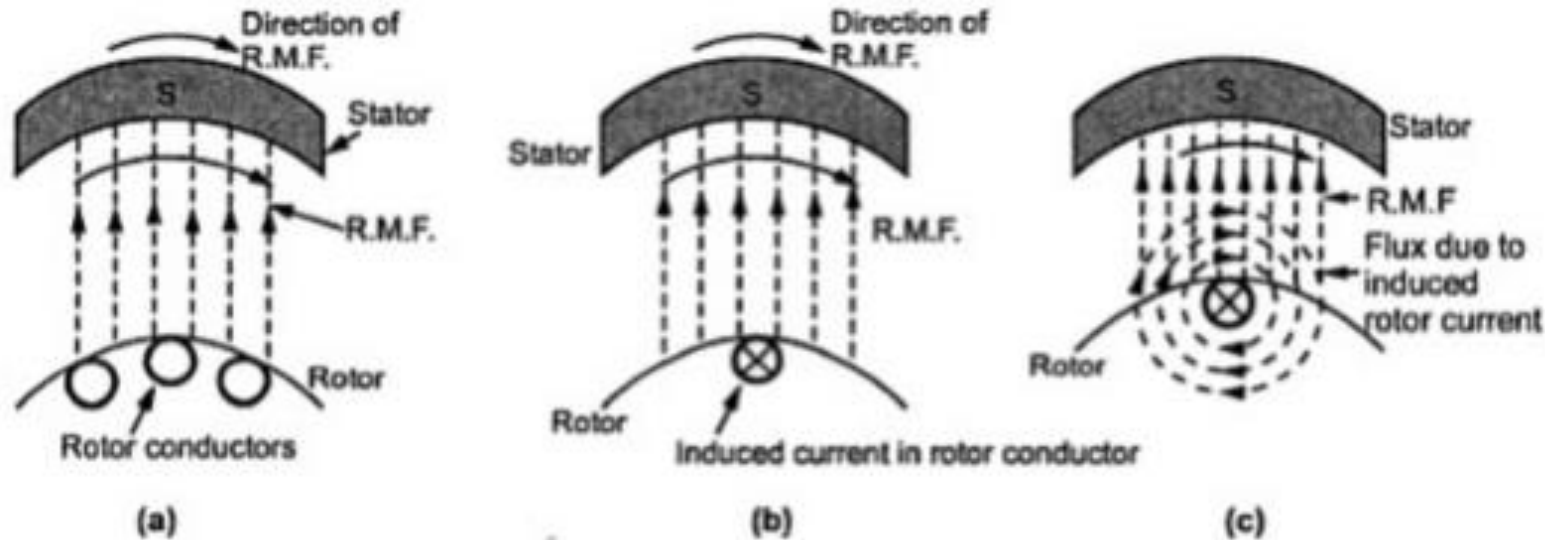
- $f = \text{supply frequency}$





Working principle:

This rotating field produces an effect of rotating poles around a rotor. Let direction of this magnetic field is clockwise as shown.





Working principle:



Now at this instant rotor is stationary and stator flux R.M.F. is rotating. So its obvious that there exists a relative motion between the R.M.F. and rotor conductors.

Now the R.M.F. gets cut by rotor conductors as R.M.F. sweeps over rotor conductors.

Whenever a conductor cuts the flux, emf. gets induced in it. So e.m.f. gets induced in the rotor conductors called rotor induced emf. this is electro – magnetic induction.

As rotor forms closed circuit, induced emf. circulates current through rotor called rotor current.





Working principle:



Any current carrying conductor produces its own flux. So rotor produces its flux called rotor flux. For assumed direction of rotor current, the direction of rotor flux is clockwise as shown.

This direction can be easily determined using right hand thumb rule.

Now there are two fluxes, one R.M.F. and another rotor flux.

Both the fluxes interact with each. On left of rotor conductor, two fluxes are in same direction hence added up to get high flux area.





Working principle:



So rotor conductor experiences a force from left to right, due to interaction of the two fluxes.

As all rotor conductor experiences a force, overall rotor experiences a torque and starts rotating.

So interaction of the two fluxes is very essential for a motoring action. As seen from the figure, the direction of force is same as that of rotating magnetic field. Hence rotor starts rotating in the same direction as that of R.M.F.





Applications of Three Phase Induction Motors



- ✓ Lifts
- ✓ Cranes
- ✓ Large capacity exhaust fans
- ✓ Engine Auxiliary pumps
- ✓ Engine blower fan motor
- ✓ Engine room heavy load pumps –Ballast, Fire, Freshwater, Sea Water etc.
- ✓ Winch motor
- ✓ Windlass motor





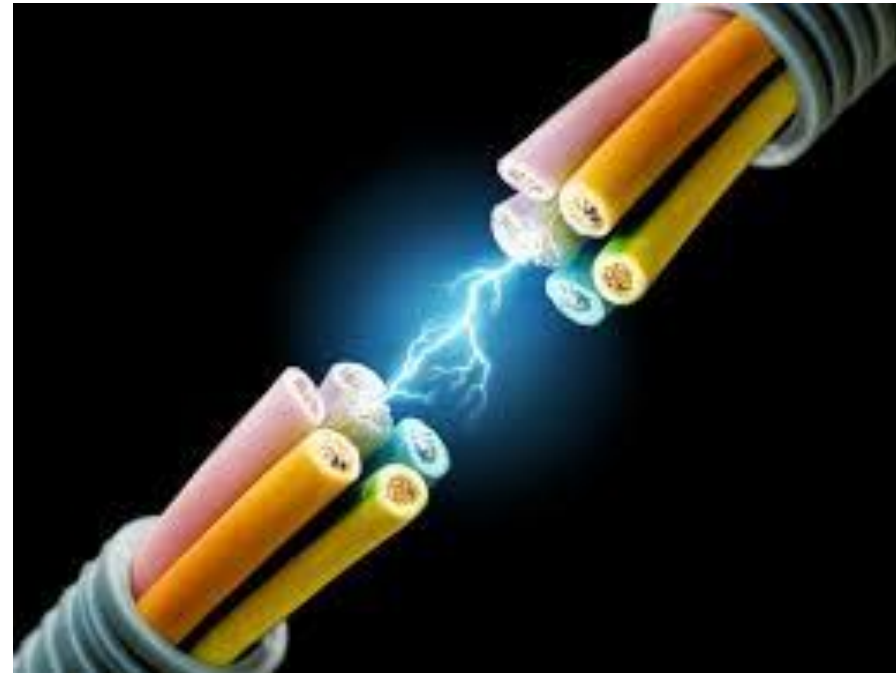
PRINCIPLE OF OPERATION OF THREE PHASE INDUCTION MOTOR

Video

<https://www.youtube.com/watch?v=cuwSCutTHEI>



RECAP...



...THANK YOU

