SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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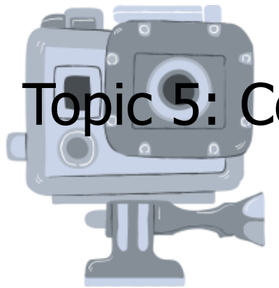
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EET207/ SYNCHRONOUS AND INDUCTION MACHINES

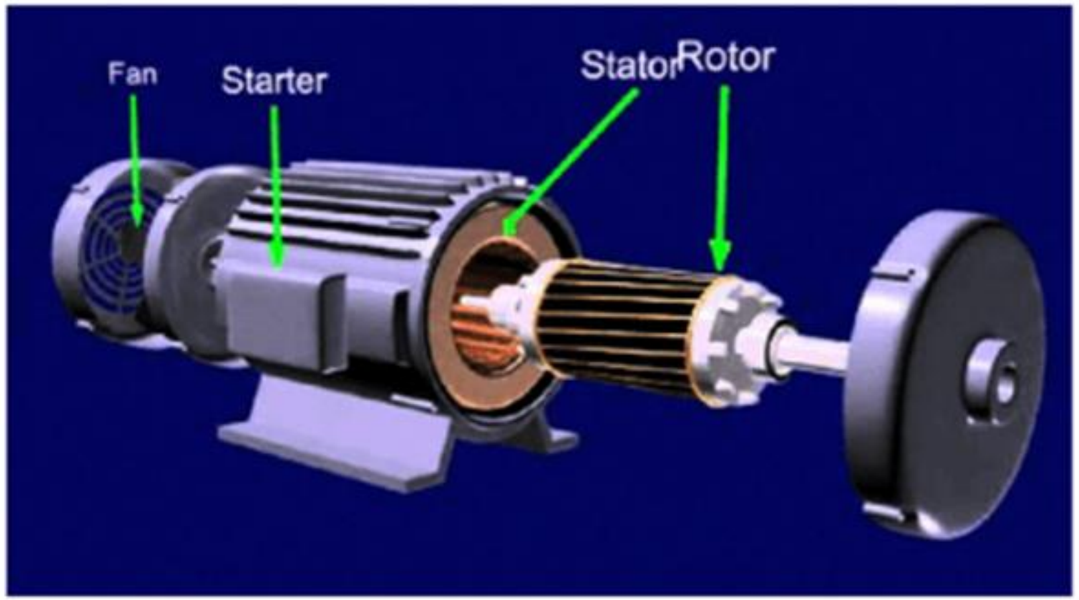
II YEAR / IV SEMESTER

Unit 4 – CONCEPT OF STARTING, BRAKING AND SINGLE PHASE INDUCTION MOTOR



Topic 5: Constructional details of single phase induction motor

GUESS THE TOPIC NAME…



Single phase induction motors

- The single-phase power system more widely than three phase system for domestic purposes, commercial purposes and some extent in industrial uses.

- Because, the single-phase system is more economical than a three-phase system and the power requirement in most of the houses, shops, offices are small, which can be easily met by a single phase system.

- The single phase motors are simple in construction, cheap in cost, reliable and easy to repair and maintain. Due to all these advantages, the single phase motor finds its application in vacuum cleaners, fans, washing machines, centrifugal pumps, blowers, washing machines, etc.

Construction of Single Phase Induction Motor

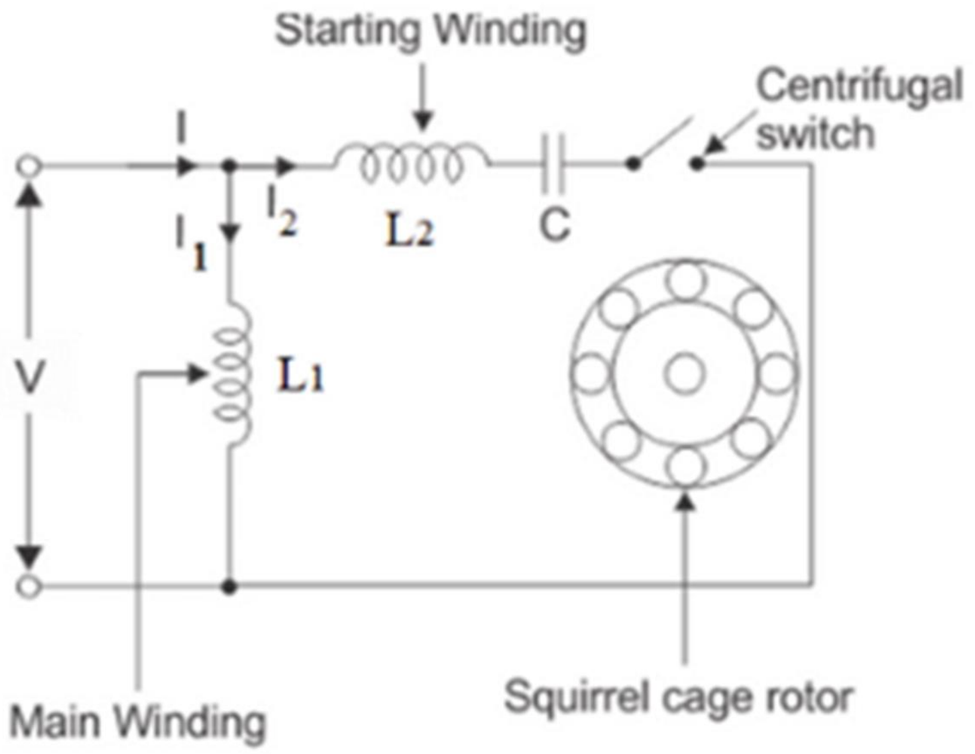
Stator:

As its name indicates stator is a stationary part of induction motor. A single phase AC supply is given to the stator of single phase induction motor.

Rotor:

The rotor is a rotating part of an induction motor. The rotor connects the mechanical load through the shaft. The rotor in the single-phase induction motor is of squirrel cage rotor type.

The construction of single phase induction motor is almost similar to the squirrel cage three-phase induction motor. But in case of a single phase induction motor, the stator has two windings



Stator of Single Phase Induction Motor

The stator of the single-phase induction motor has laminated stamping to reduce eddy current losses on its periphery. The slots are provided on its stamping to carry stator or main winding. Stampings are made up of silicon steel to reduce the hysteresis losses. When we apply a single phase AC supply to the stator winding, the magnetic field gets produced, and the motor rotates at speed slightly less than the synchronous speed Ns. Synchronous speed Ns is given by

$$N = 120f/p$$

Where,

f = supply voltage frequency,

P = No. of poles of the motor.

The construction of the stator of the single-phase induction motor is similar to that of three phase induction motor except there are two dissimilarities in the winding part of the single phase induction motor.

Rotor of Single Phase Induction Motor

- The rotor is cylindrical and has slots all over its periphery. The slots are not made parallel to each other but are a little bit skewed as the skewing prevents magnetic locking of stator and rotor teeth and makes the working of induction motor more smooth and quieter (i.e. less noisy).

- The squirrel cage rotor consists of aluminum, brass or copper bars. These aluminum or copper bars are called rotor conductors and placed in the slots on the periphery of the rotor. The copper or aluminum rings permanently short the rotor conductors called the end rings.

- To provide mechanical strength, these rotor conductors are braced to the end ring and hence form a complete closed circuit resembling a cage and hence got its name as squirrel cage induction motor. As end rings permanently short the bars, the rotor electrical resistance is very small and it is not possible to add external resistance as the bars get permanently shorted. The absence of slip ring and brushes make the construction of single phase induction motor very simple and robust.

Why Single Phase Induction Motor is not Self Starting?

- According to double field revolving theory, we can resolve any alternating quantity into two components. Each component has a magnitude equal to the half of the maximum magnitude of the alternating quantity, and both these components rotate in the opposite direction to each other. For example – a flux, ϕ can be resolved into two components

- Each of these components rotates in the opposite direction i. e if one ϕm/2 is rotating in a clockwise direction then the other ϕm / 2 rotates in an anticlockwise direction.

- When we apply a single phase AC supply to the stator winding of single phase induction motor, it produces its flux of magnitude, ϕm. According to the double field revolving theory, this alternating flux, ϕm is divided into two components of magnitude ϕm/2. Each of these components will rotate in the opposite direction, with the synchronous speed, Ns.

Why Single Phase Induction Motors not Self Starting?

- These two components of flux as forwarding component of flux, ϕf and the backward component of flux, ϕb. The resultant of these two components of flux at any instant of time gives the value of instantaneous stator flux at that particular instant.

- Now at starting condition, both the forward and backward components of flux are exactly opposite to each other. Also, both of these components of flux are equal in magnitude. So, they cancel each other and hence the net torque experienced by the rotor at the starting condition is zero. So, the single phase induction motors are not self-starting motors.

- The solution to this problem is that if we make the stator flux rotating type, rather than alternating type, which rotates in one particular direction only. Then the induction motor will become self-starting.

SUMMARY

conclude that the single-phase induction motors are not self-starting because the produced stator flux is alternating in nature and at the starting, the two components of this flux cancel each other and hence there is no net torque.

KEEP
LEARNING..

Thank u

SEE YOU IN NEXT CLASS