Hour-7

Single Phase Induction Motors:

Evocation:

Going to show an video for construction and operation of single phase Induction motors.

Introduction:

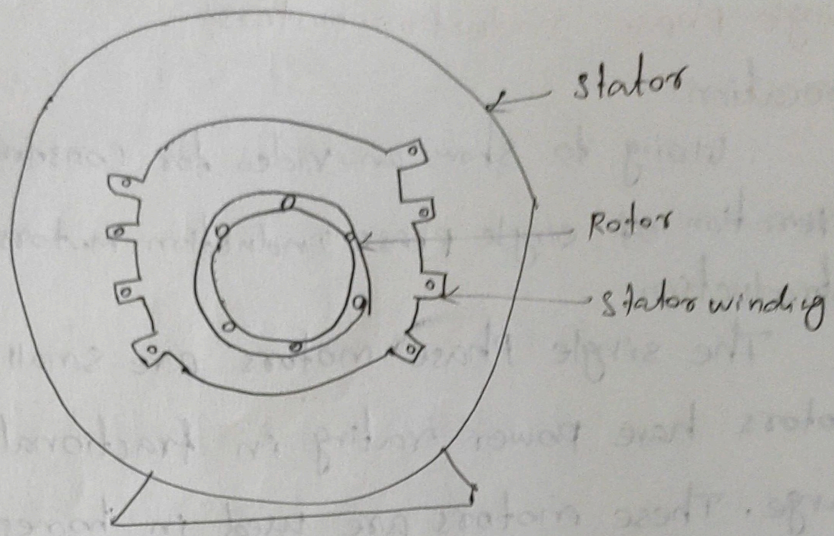
The single phase motors are small motors. These motors have power rating in fractional horse power range. These motors are used in homes, offices, shops and factories. They provide motive power for fans, washing machines, hand tools like, drillers, record player, refrigerators, juice makers etc. It's simple in construction. The main disadvantages are

* Lack of starting torque
* Reduced power factor
* Low efficiency.

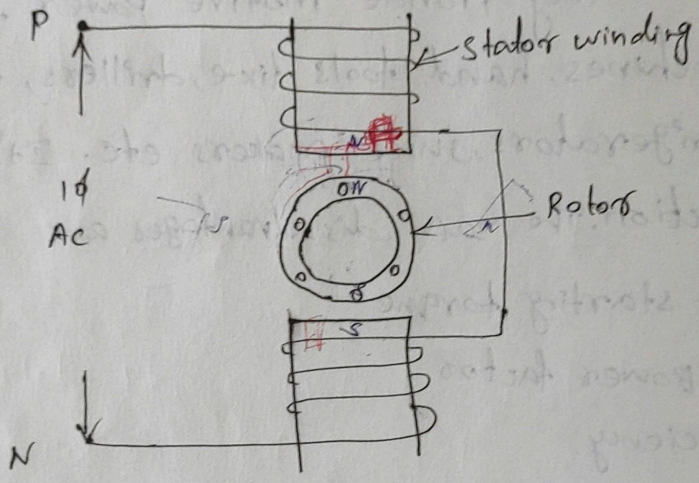
Concept:

Construction of single phase Induction Motor:

* It is similar to 3ϕ squirrel cage induction motor. The rotor is the same as that of a 3ϕ induction motor, but the stator has only a single phase distributed winding.
* It consists of 2 parts, one is stator and another one is rotor. The air gap between stator and rotor is uniform. There is no external connation between stator and rotor.



Fig(a)



Fig(b)

Operation of Single phase Induction motor.

The Stator winding of a single phase induction motor is connected to single phase Ac supply. Then a magnetic field is developed in the stator whose axis is always along the axis of stator windings. with alternating current in the fixed stator coil, the mmf ware is stationary in space but pulsates in magnitude and varies sinusoidally with time.

Due to the transformer action, currents are induced in the rotor conductors. The direction of the current is to oppose the stator mmf.

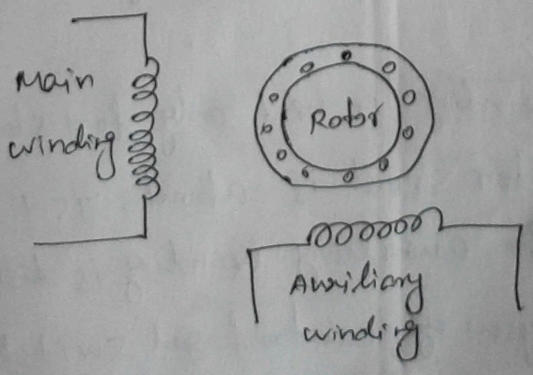
Thus the axis of rotor mmf wave coincides with the axis of stator mmf wave. Therefore, the torque angle is zero and no starting torque is developed in the motor. However, if rotor is initially given a starting torque by some means, the motor will picle-up the speed and continue to rotate in the same direction.

Thus the sirgle phase induction motor is not a self starting motor. The starting torque can be produced by some external arrangement.

starting of sirgle phase induction motor:

The starting method of sirgle phase induction motor is very simple. An auxiliary winding in the stator is provided in addition to the main winding. Then the induction motor starts as a 2 phase motor.

The main winding axis and auxiliary winding axis are displaced by 90 electrical degrees. The impedance of the windings differ and currents in the main and auxiliary winding are phase shifted from each other. As a result of this, a rotating stator field is produced and the rotor rotates.



When the motor speed is about 75% of synchronous speed, the auxiliary winding is disconnected from the circuit. This is done by connecting a centrifugal switch in the auxiliary winding which is used for starting purpose only.

That is why it is called starting winding. Under running condition, a single phase induction motor can develop torque with only the main winding. That is why it is called running winding.

Hour-3

Types of single phase Induction Motors:

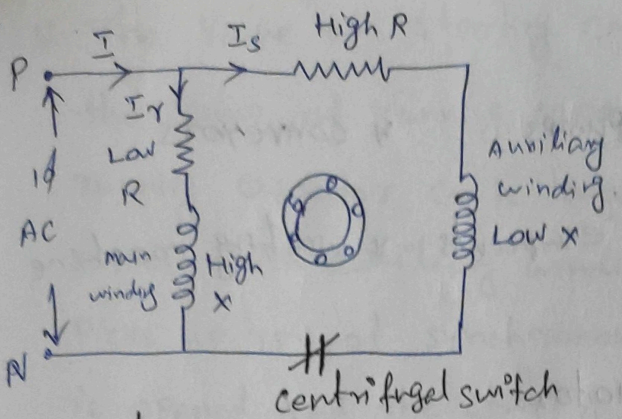
The classifications are

(i) split-phase Induction Motors:

It consists of 2 stator winding. one is the main winding (or) running winding and another is auxiliary winding (or) starting winding. These two winding axes are displaced by 90 electrical degrees. The auxiliary winding has high resistance and low reactance and main winding has low resistance and high reactance.

I_r is the current flowing through the running winding and I_s is the current flowing through the starting winding.

The auxiliary winding is used only for starting Period. When the motor speed is about 75% of synchronous speed, the auxiliary winding is disconnected from the circuit by using centrifugal switch. After this, motor runs because of main winding only.

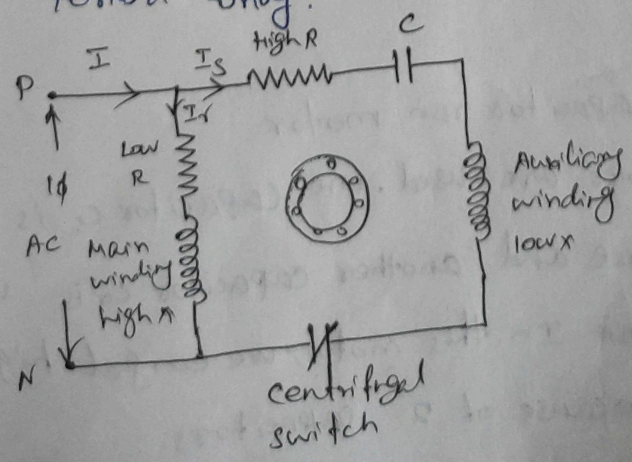


Applications:

* Fans
* Blowers
* Centrifugal pumps
* Washing machines

(ii) Capacitor start single phase Induction Motor:

* Here, a capacitor is connected in series with the auxiliary winding.
* 1φ supply is applied to the two winding. The starting current (I_s) leads the voltage because of the capacitor present in the auxiliary winding. The running current (I_r) lags the line voltage.
* The phase displacement between the two currents are approximately equal to 90° during starting.
* Again the auxiliary winding is disconnected from the circuit by centrifugal switch at 75% of the synchronous speed i.e the capacitors is used during starting Period only.



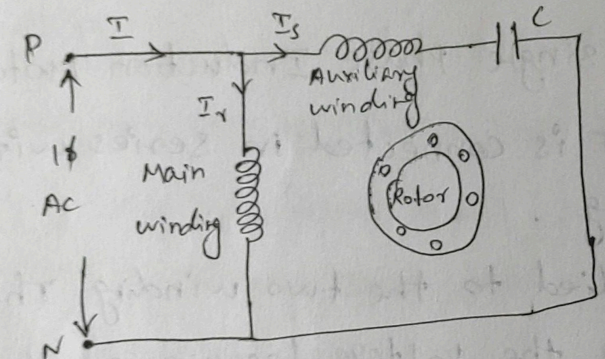
Applications:

* Compressors * Pumps * Conveyors
* Refrigerators * Ac equipments * Washing machine

Hour-9

(iii) Capacitor-Run Motor:

* In this motor, a capacitor is permanently connected in series with the auxiliary winding. Here the centrifugal switch is not needed and therefore the cost of the motor is less.



Advantages:

* High Power factor at full-load
* High full load efficiency
* Increased pull-out torque

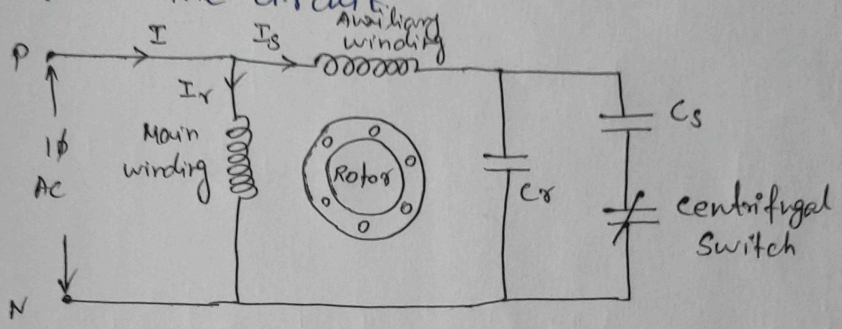
Applications:

* Fans
* Blowers
* centrifugal pumps

(iv) Capacitor start-capacitor run motor:

* Here 2 capacitors are used. one capacitor C_s is used for starting purpose and another capacitor C_r is used for running purpose. In this motor, we can get high starting torque, because of 2 capacitors.

* The value of starting capacitor C_s is large and the value of running capacitor C_r is small. The running capacitor C_r is ~~large~~ permanently connected in series with auxiliary winding. when the motor speed picks up 75% of synchronous speed, the centrifugal switch is opened and the starting capacitor C_s is disconnected from the circuit.



Advantages:

* High starting torque
* High efficiency
* High power factor

Applications:

It's for low noise & high starting torque

* Compressors
* Pumps
* Conveyors
* Refrigerators.