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Q# 1:- Write introduction, Advantages, disadvantages and Construction of three Phese Motor

Introduction:-

The three phase induction motor are the most widely used electric motor in industry. They run at essentially constant speed from no-load to full load. However the speed is frequency depend and, consequently these motor are not easily adapted to speed control. We usually prefer d.c motor when large speed variations are required. Nevertheless, the 3ϕ Induction motors are simple, rugged, low priced, easy to maintain and can be manufactured with characteristics to suit most industrial requirements. 3ϕ induction motor stator and a rotor. The stator carries a 3ϕ winding while the rotor carries a short circuited winding. only the stator winding is feed from 3ϕ supply.

Advantages:-

(i) The working of the motor is independent of the environmental condition. This is because the induction motor is Robust and mechanically strong.

(ii) A squirrel cage induction motor does not contain Brushes, slip rings and Commutator. Due to this reason, the cost of the motor is quite low.

(iii) Due to absence of Brushes there are no spark in the motor. It can also be operated in hazardous conditions.

(iv) Unlikely Synchronous motor, a 3ϕ induction motor has a high starting torque, good speed regulation and reasonable overload Capacity.

(v) An induction motor is a highly efficient machine with full load ~~vary~~ efficiency varying from 85 to 97 percent.

Disadvantages:-

(i) A 3ϕ induction motor does not have a self starting torque. Auxiliaries are required to start a motor.

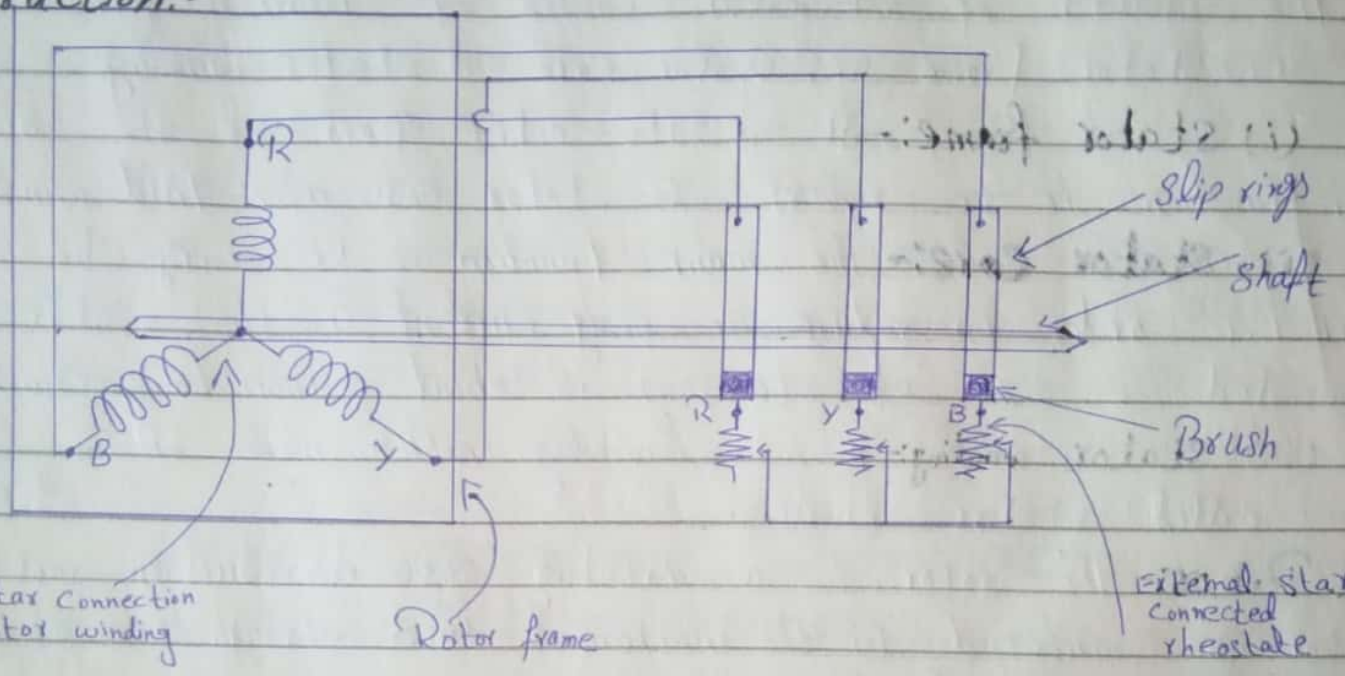
(ii) During light load conditions, the power factor of the motor drops to a very low value. the motor draws a large magnetising current to overcome the reluctance offered by the air gap b/w the stator and rotor.

(iii) Speed control of an induction motor is very difficult to attain. This is because a 3ϕ induction motor is a constant speed motor and for the entire loading range, the change in speed of the motor is very low.

(iv) Induction motor have high input surge current, which are refered to as Magnetising inrush currents. This cause a reduction in voltage at the time of starting the motor.

(v) Due to poor starting torque, the motor cannot be used for applications which require high starting torque.

Construction:-



3 ϕ Induction Motor is Contructed from two main parts, namely the rotor and stator.

1. **Stator**. As its name indicates stator is stationary part of induction motor. A stator winding is placed in the stator of induction motor and the three phase supply is given to it.

The stator of 3ϕ motor Consist of following parts:
(i) Stator frame (ii) Stator Core (iii) Stator winding

(i) Stator frame:- It is the outer part of the motor. Its main function is to support the stator core and field winding.

(ii) Stator Core:- The main function is to carry the alternating flux. In order to reduce the eddy Current loss the stator core is laminated. The size of stamping is about 0.4mm to 0.5mm.

(iii) Stator winding:- The ~~which~~ winding which made of the stator is called stator winding.

2. Rotor:- The rotor is a rotating part of induction motor. The rotor is Connected to the machanical load through the shaft.
(i) Squrrel cage rotor
(ii) Slip ring rotor

The other part of 3ϕ induction motor are:
1. Shaft for transmitting the torque to the load. This shaft is made up to steel.

2. Bearing for supporting the rotating shaft
3. one of the Problems with electrical motor is the production of heat during its rotation. To overcome the Problem we need a fan for Cooling.
4. For receiving external electrical Connection Termined box.
5. There is a small distance between rotor and stator which usually varies from 0.4 to 4mm.

Q#2:-

Write operationd Principle of 3 ϕ induction motor:

The stator of the motor Consist of overlapping winding offset by an electrical angle of 120° when we Connect the Primary winding or the stator to a 3 ϕ AC source, it establishes rotating magnetic field which rotates at the Synchronous Speed.

According to Faraday's law an emf induced in any Circuit

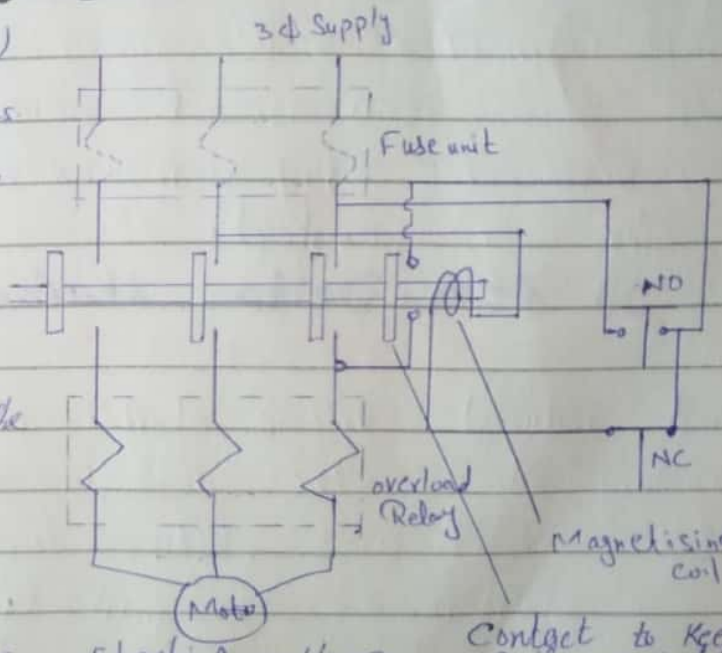
is due to the rate of change of magnetic flux linkage through the circuit. As the rotor winding in an induction motor are either closed through an external resistance or directly shorted by end ring, and cut the stator rotating magnetic field, an emf is induced in the rotor copper bar and due to this emf a current flows through the rotor conductor. Here the relative speed b/w the rotating flux and static rotor conductor is the cause of current generation; hence as per lenz's law, the rotor will rotate in the same direction to reduce the cause i.e. the relative velocity. Thus from the working principal of three phase induction motor it may be observed that the rotor speed should not be reach the synchronous speed produced by the stator. If the speed became equal, there would be no such relative speed, so no emf induced in the rotor, and no current would be flowing, and therefor no torque would be generated. Consequently the rotor

Q#3

Discuss different types of starter for 3 ϕ induction Motor:-

1) Direct on-line starter:-

The Small Capacity motors (below 5 HP) does not have very high starting Currents And without using any starter, Such motors Can withstand the starting Currents. There is no need to reduce the voltage to the motor at start and hence motor can be Connected direct to the Supply lines. This type of arrangement employed in a started is refered as direct on-line starter or Simply DOL. Although, this starter doesn't reduce the starting voltage it provides the Protection to the motor against overloading Single

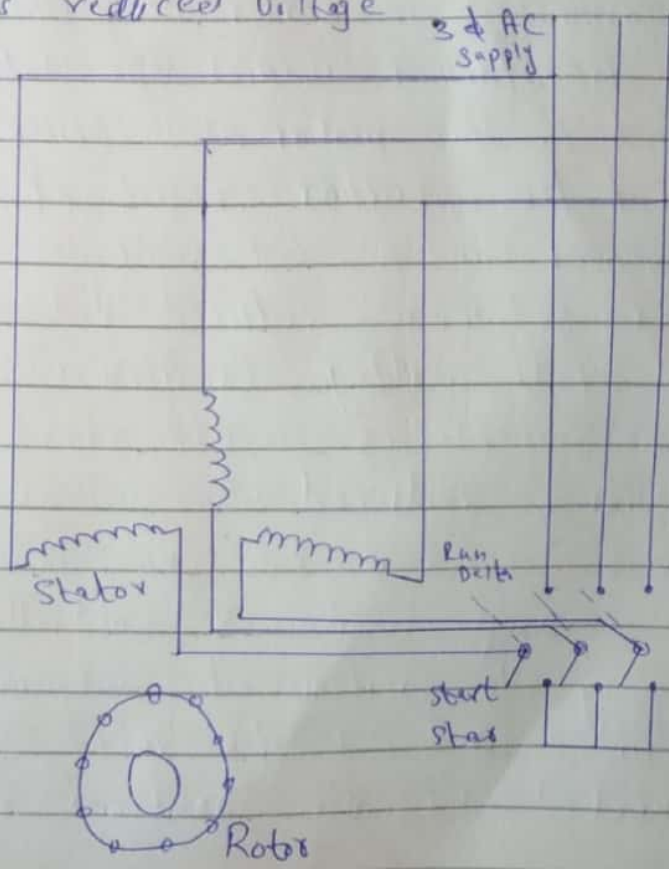


Phasing and low voltage. During start condition, normally open Contact is pushed for fraction of a Second and this makes the magnetising coil becomes energised. This magnetic flux produced by the coil attracts the Contactor so that the motor is now Connected to the Supply. when a N/C Switch is Pressed the coil becomes de-energised and the Contactor get Separated by Spring arrangement there by the Supply to the motor is removed.

2) Star-Delta starter:-

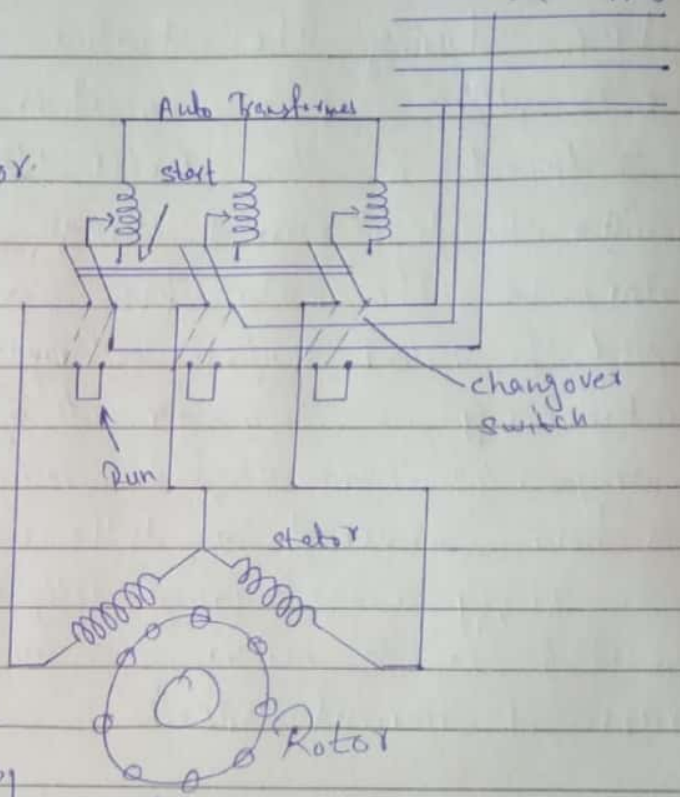
It is the most Commonly used reduced Voltage Starter as it is the cheapest starter among all. In this method induction motor is Connected in star during start and delta while running with rated speeds. These starters are designed to run on delta Connected stator of an induction motor. This starter uses a triple Pole double throw (TPDT) Switch and it Connects the stator winding in

star during the starting condition.
Due to this star connection, the applied voltage to the motor is reduced by the factor $1/\sqrt{3}$. This reduced voltage results the less current through the motor. when the motor pick up the speed the TPST switch is thrown automatically on the other side by using relays such that the winding is now connected in delta across the supply. So the normal voltage is applied to the motor the motor runs at normal speed.



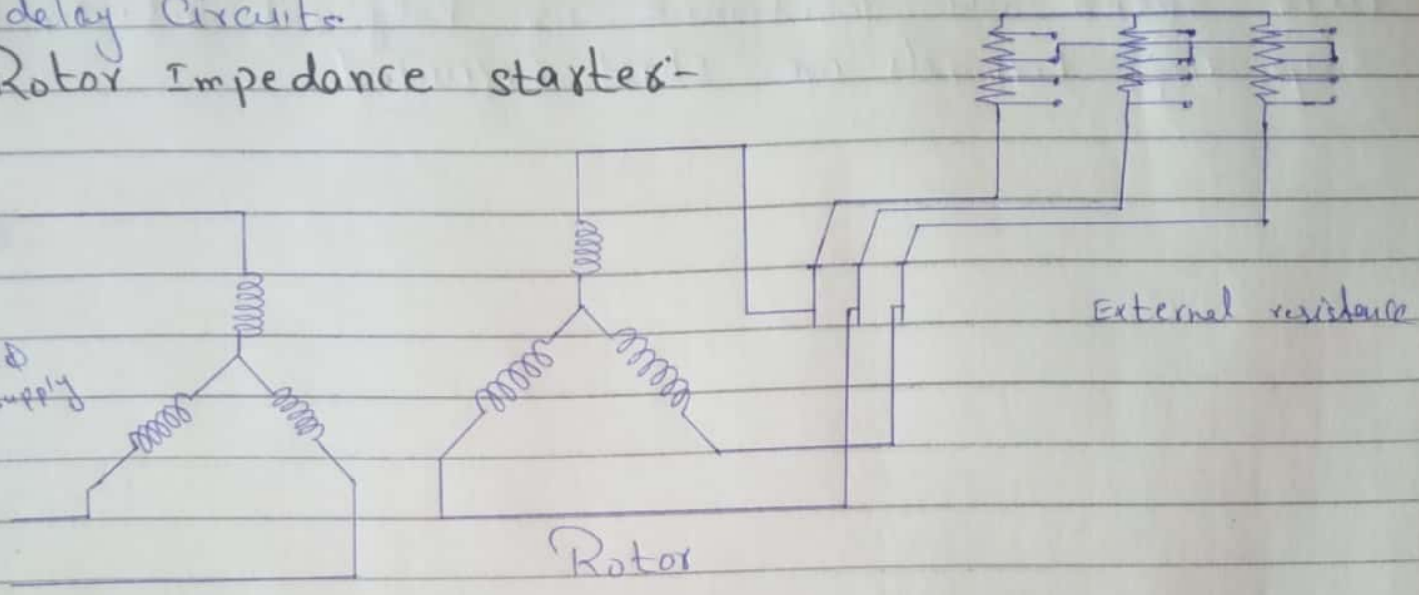
3) Auto transformer starter:-

In this method, a 3ϕ auto T/F is connected in series with the motor. This transformer reduces the voltage applied to the motor and hence the current. The starter consist of changeover switch that switches the motor between reduced voltage and full voltage condition. when this switch is in the start position, a reduced. This voltage depend on the fractional percentage of tapings and is controlled by changing the position of autotransformer slides. when the motor attain 80% of its rated speed, the changeover switch is connected to run position automatically using relays. Due to



this a rated voltage is then applied to this motor. These transformer are also provide with overload no-load and time delay Circuits.

4) Rotor Impedance starter:-



The easiest Method of starting wound rotor induction motor is to Connect Some extra resistance in the rotor Circuit Connection of extra resistance in the rotor Circuit decrease and at the Same time increase the

starting torque. As the motor starts rotating the extra resistance is gradually cut out. when the motor attains rated speed the resistance is fully cut out. and the slip ring terminals are short circuited.