

# Assignment

## Electric Machines - II

Name

Bilal Ahmad

Roll no

12545

Government College University  
Faisalabad

Question no - 1

"Three Phase Induction Motor"

Introduction:-

The popularity of 3-Phase induction motors on board ships is because of their simple robust construction, and high reliability factor in the sea environment.

A 3-Phase induction motor can be used for different applications with various speed and load

Considered to be a transformer with a rotating secondary and it can therefore be described as a machine in which electrical energy is converted into mechanical energy.

### Advantages :-

- it has simple and rugged construct.
- it is relatively cheap.
- it has high frequency and reasonable good power factor.
- it has self starting.
- it requires little maintenance.

### Disadvantages :-

- It is essentially a constant speed motor and its speed cannot be changed easily.
- Its starting torque is inferior to D.C motor shunt.

### Construction :-

The Three-Phase induction motor is the most widely used electrical motor.

Almost, 80% of the mechanical power

used by industries is provided by the 3-phase induction motor because of its simple and rugged construction, low cost, good operating characteristics, absence of commutator and good speed regulation.

In three-phase induction motors is also power is transferred from stator to rotor winding through induction.

A 3-phase induction motor have two main parts ;

rotor is separated from air-gap which ranges from 0.4mm to 4mm depending on the power of the motor.

The main body of induction motor comprises of two major parts of shows.

- Shaft for transmitting the torque to the load. The shaft is made up of steel.
- Bearing for supporting the rotating shaft.
- One of the problem with electrical motor is the product of heat during its

- rotating. in order to overcome this problem we need fan for cooling.
- for receiving electrical connect terminal box is needed.
  - There is a small distance between rotor and stator which usually varies from 0.4mm to 4mm. Such a distance is called air-gap

## Question no. 2

### Operational Principal :-

unlike toys and flashlights, most homes, offices, factories and other buildings aren't powered by little batteries; they are not supplied with DC current (AC) which reverses its direction about 50 times per second (with the frequency of 50Hz). If you want to run a motor from your household AC electricity supply instead of from a DC battery, you need a different design of motor.

Inside the stator, there's a solid

metal rotor, a squirrel cage made of metal bars and interconnections (like the rotating cages people sometimes get to amuse pet mice), or some other freely rotating metal part that can conduct electricity. The outer coils that make up the stator.

The coils are energized in pairs, in sequence, producing a magnetic field that rotates around the outside of the motor.

If the conductor is a ring or a wire, the current flows around it in a loop - if the conductor is simply a solid piece of metal, eddy currents swirl around it instead.

The induced current produces its own magnetic field and, according to another law of electromagnetism (Lenz's law) tries to stop whatever it is that causes it. The rotating magnetic field by rotating as well. (you can think of the "catch up" with the rotating

rtant:

magnetic field in an effort to eliminate the difference in motion between them.)

Electromagnetic induction is the key to why a motor like this spins and that's why it's called an induction motor.

An electrical motor converts electrical energy into mechanical energy which is

supplied to them different types of loads. AC motors operate on AC

supply and they are classified into synchronous, single phase

and 3-phase induction motors are most usually used for industrial applications mainly because they do not require a starting

device. Three phase induction

motor derives its name for the fact that the rotor current is induced by the magnetic field instead of electrical current.

### Question no. 3

Important:

Direct Online Stator (DOL) :-

The Direct on-line stator (DOL) is the simplest and the most expensive of all starting methods and usually used for squirrel cage induction motors.

It directly connects the contacts of the motor to the full supply voltage.

The starting current is very large, normally 6 to 8 times the rated current. The starting torque is likely to be 0.75 to 2 times the full load torque. In order to avoid excessive voltage drops in the supply currents, the DOL stator is used only for ratings of less than 5 kW.

The DOL stator consists of a coil operator contactor KIM controlled by start push button S1, the contactor coil KIM is energized from line L1.

The motor is thus connected to the supply. When the stop push button S2 is pressed, the supply through the contactor KIM is

disconnected.

Since the KIM is de-energized, the main Contact (1-2)(3-4) and (5-6) are opened. The supply to motors is disconnected and the motor stops.

### • Star-Delta starter :-

The star delta starting is a very common type of starter and extensively used, compare to the other types of the starter these method used reduced supply voltage in starting. The connection of a 3-phase induction motor with a star delta starter.

The light current drawn by the motor at starting current with the windings connecting in delta.

At the time of starting when the stator winding are start connector each stator phase gets voltage  $V_L/\sqrt{3}$ , where  $V_L$  is the torque developed by an induction motor is proportional to the square of applied voltage, star-delta starting torque to one third that obtainable by direct



delta starting.

## • Auto Transformer Starter :-

The operation principle of auto transformer method is similar to the star-Delta method is limited by (using a 3-phase auto transformer) reduced the initial stator applied voltage.

The auto transformer starter is more expensive, more complicated in operation and bulkier in construction when compared with the star-Delta starter method. But an auto transformer starting current and torque can be adjusted to a desired value by taking the auto transformer. When the star-Delta method is considered, voltage can be adjusted only by factor of  $\frac{1}{\sqrt{3}}$ . It can be adjusted only by brief operation of auto transformer as :-

• Operated by a two position switch manually automatically using a time to change over from star to

- run position.
- In starting position supply is connected to star windings through an auto transformer which reduces applied voltage to 50, 60, and 70% of normal voltage depending on tapping used.
  - Reduced voltage reduces current in motor windings with 50% of tapping used motor current is halved and supply current will be half of the motor current.
  - For an induction motor torque  $T$  is developed by  $v^2$ ; Thus on 50% tapping torque at starting is only  $(0.5v)^2$  of the obtained by DOL starting. Hence 25% torque is produced.
  - Starters used in larger industries, it is larger in size and expensive.

## Rotor Impedance Starter :-

This method allows external resistance to be connected to the rotor through sliprings and brushes. Initially, the rotor resistance is

Set to maximum and is then generally decreased as the motor speed increased, until it become zero.

The rotor impedance starting mechanism is usually very bulky and its expensive when compare with other method. It also has very high maintenance cost. Also, considerable amount of heat is generated through them. The starting frequency is also limited in this method allows the motor to be started while on load. This will decrease the starting current, increase the starting torque and also improves the power factor.

At the time of starting of the motor the entire external resistance is added in rotor circuit.

Then the external rotor resistance is decreased in steps as the rotor speed up, However the motor torque remain maximum during the acceleration period of the motor.

requirements.

Electric motors can be found in almost every production process today. Getting the most out of your application is becoming more and more important in order to ensure cost effective operations.

The three-phase inducting motors are the most widely used electric motors used in industries.

They run at essentially constant speed from on-load to full-load.

However, the speed is frequency dependant and consequently,

these motors are not easily adopted to speed control.

We usually prefer D.C motors when large speed variations are required.

Nevertheless, the 3-phase induction motors are simple, rugged, low-priced, easy to maintain and can be manufactured with characteristics is suit most industrial requirements. The rotor winding through electromagnetic induction and hence the name.

The induction motors may be