



# SNS COLLEGE OF ENGINEERING

Kurumbapalayam (PO), Coimbatore – 641 107

## AN AUTONOMOUS INSTITUTION

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

### DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING



## UNIT-III THREE PHASE INDUCTION MOTOR

### 1. What are types of 3- phase induction motor?

- i. Squirrel cage induction motor
- ii. Slip ring induction motor

### 2. Why the rotor slots of a 3-phase induction motor are skewed?

The rotor slots of a three -phase induction motor are skewed

- i. to make the motor run quietly by reducing the magnetic hum
- ii. to reduce the locking tendency of the rotor

### 3. Why the induction motor is called asynchronous motor?

Since the induction motor runs always at a speed lesser than synchronous speed, it is called asynchronous motor.

### 4. What are slip rings?

The slip rings are made of copper alloys and are fixed around the shaft insulating it. Through these slip rings and brushes the rotor winding can be connected to external circuits.

### 5. State the difference between slip ring rotor and cage rotor of an induction motor?

Slip ring rotor has 3-phase windings. Three ends of which are started and the other three ends are brought up and connected to 3 slip rings mounted in the shaft. Extra resistance can be added in the rotor circuit. Squirrel cage rotor has short-circuited copper bars. Extra resistance can't be added as slip ring rotor.

### 6. Write an expression for the slip of an induction motor.

$$\text{Percentage slip} = \left( \frac{N_s - N_r}{N_s} \right) * 100$$

### 7. What is cogging of an induction motor?

When the number of stator and rotor teeth's is equal or integral multiple of rotor teeth, they have a tendency to align themselves exactly to minimum reluctance position. Thus, the rotor may refuse to accelerate. This phenomenon is known as cogging.

### 8. Explain why the no load current of an induction motor is much higher than that of an equivalent transformer.

In induction motor, due to the presence of the air gap, the magnetizing current that is required to set up the flux is much higher. The working component of the current has to meet the hysteresis loss, eddy current loss, friction and windage losses. Hence the no load current of induction motor is higher.

### 9. Write the two extra features of slip ring induction motors.

- Rotor is having 3-phase winding.
- Extra resistance can be added in the rotor circuit by connecting through the help of



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three slip rings for improving the power factor, increasing Starting Torque, limiting the starting current.

#### 10. Can we add extra resistance in series with squirrel cage rotor? State the reason?

We cannot add extra resistance in series with the rotor because all the copper bars of the rotor are short circuited in both the sides by copper end rings to have a closed circuit.

#### 11. Why an induction motor is called rotating transformer?

The rotor receives electrical power in exactly the same way as the secondary of a two winding transformer receiving its power from primary. That is why an induction motor can be called as a rotating transformer i.e., in which primary winding is stationary but the secondary is free to rotate.

#### 12. Why an induction motor will never run at its synchronous speed?

If it runs at synchronous speed then there would be no relative speed between the two, hence no rotor emf, no rotor current so no rotor torques to maintain rotation. That is why the rotor runs at its synchronous speed.

#### 13. State the effect of rotor resistance on starting torque?

Starting torque increases with increase in value of rotor resistance.

#### 14. What are the advantages of cage motor?

- Since the rotor has very low resistance, the copper loss is low and efficiency is high
- On the account of simple construction of rotor, it is mechanically robust.
- Initial cost is less.
- Maintenance cost is less.
- Simple starting arrangement

#### 15. Give the conditions for maximum torque for 3-phase induction motor?

The rotor resistance and rotor reactance should be equal for developing maximum torque i.e.  $R_2 = s X_2$  where  $s$  is the slip under running conditions.  $R_2 = X_2$  under starting conditions

#### 16. What is reason for inserting additional resistance in rotor circuit of a slip ring induction motor?

Introduction of additional resistance in the rotor circuit will increase the starting torque as well as running torque. Also, it limits the starting current, improves the power factor.

#### 17. List out the methods of speed control of cage type 3-phase induction motor?

- a. By changing supply frequency
- b. By changing the number of poles
- c. By operating two motors in cascade

#### 18. Mention different types of speed control of slip ring induction motor?

- a. By changing supply frequency
- b. By changing the number of stator poles



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- c. By rotor rheostat control
- d. By operating two motors in cascade

#### 19. What are the advantages of 3-phase induction motor?

- a. It was very simple and extremely rugged, almost unbreakable construction
- b. Its cost is very low and it is very reliable
- c. It has been sufficiently high efficiency. No brushes are needed and hence frictional losses are reduced
- d. It requires minimum of maintenance.

#### 20. What does crawling of induction motor mean?

Squirrel cage type, sometimes exhibit a tendency to run stably at speeds as low as 1/7 the of their synchronous speed, because of the harmonics this phenomenon is known as crawling

#### 21. Why is the efficiency of a 3-phase induction motor less than of a transformer?

In induction motor, there is a mechanical loss due to the rotation of the rotor. Hence the efficiency of an induction motor is less than that of the transformer.

#### 22 What are the principal advantages of rotating field type construction?

Relatively small amount of power required for field system can easily supplied to rotating system using slip rings and brushes, more space is available in the stator part of the machine to provide more insulation, it is easy to provide cooling system, stationary system of conductors can easily be braced to prevent deformation.

#### 23 What are the advantages of cage motor?

Since the rotor has low resistance, the copper loss is low and efficiency is very high. On account of simple construction of rotor it is mechanically robust, initial cost is less; maintenance cost is less, simple starting arrangement.

#### 24 Why an induction motor is called as rotating transformer?

The rotor receives same electrical power in exactly the same way as the secondary of a two winding transformer receiving its power from primary. That is why induction motor is called as rotating transformer.

#### 25 Define-Slip frequency.

The relation motion of the stator flux and the rotor conductors induces the voltage offrequency  $S_f$  called slip frequency.

#### 26 Define- Asynchronous torque.

When stator and rotor fields are stationary with respect to each other, a steady torque is produced and rotation is maintained. Such a torque existing at any mechanical speed other than synchronous speed is called as an asynchronous torque.

#### 27 What is the main use of squirrel cage winding in synchronous motor starting?



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When a squirrel cage winding called the amortisseur or damper winding is inserted in the rotor pole faces, the rotor comes up to the synchronous speed by induction motor action with the field winding unexcited.

### **28 What is breakdown torque?**

From the torque versus slip characteristics, we can infer that as the torque increases, slip increases upto a maximum torque developed is called a breakdown torque.