

EC6352-ELECTRICAL ENGINEERING AND
INSTRUMENTATION

UNIT – III
PART – A

INDUCTION MOTORS

1. What are the 2 types of 3phase induction motor? Squirrel cage and slip ring induction motor.

2. Write two extra features of slip ring induction motor?

Rotor has 3-phase winding. Extra resistance can be added in rotor circuit for improving PF with the help of three slip rings.

3. 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.

4. Why an induction motor never runs at its synchronous speed?

If the motor runs at sync. speed then there would be no relative speed between the two, hence no rotor emf, so no rotor current, then no rotor torque to maintain rotation.

5. 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 rotor winding can be connected to external circuit.

6. 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.

7. Give the condition for maximum torque for 3phase induction motor, when it is running?

The rotor resistance and reactance should be same for max.torque i.e. $R_2 = Sx^2$

8. List out the method for speed control of 3phase cage type induction motor? By changing supply frequency

By changing no of poles

By operating the two motors in cascade

9. Name the two winding of single phase induction motor?

Running and starting winding.

10. What are methods available for making single phase induction motor a self starting?

By slitting the single phase, by providing shading coil in the poles.

11. What is the function of capacitor in single phase induction motor?

To make phase difference between starting and running winding, to improve PF and to get more torque.

12. State any 4 use of single phase induction motor?

Fans, wet grinders, vacuum cleaner, small pumps, compressors, drills.

13. What kind of motors used in ceiling fan and wet grinders?

Ceiling fan - Capacitor start and capacitor run single phase induction motor, wet grinders - Capacitor start capacitor run single phase induction motor.

14. What is the application of shaded pole induction motor?

Because of its small starting torque, it is generally used for small toys, instruments, hair driers, ventilators.etc.

15. In which direction a shaded pole motor runs?

The rotor starts rotation in the direction from unshaded part to the shaded part.

16. Why single phase induction motors have low PF?

The current through the running winding lags behind the supply voltage by large angle so only single phase induction

17. Differentiate between “capacitor start” & “Capacitor start capacitor run” single Phase induction motor (IM)?

Capacitor start – capacitor run is connected series with starting winding, but it will be disconnected from supply when motor pick up its speed. Capacitor start capacitor run- starting winding and capacitor will not be disconnected from supply even though motor pickup its speed.

18. Explain why single phase induction motor is not a self starting one?

When motor fed supply from single phase, its stator winding produces an alternating flux, which doesn't develops any torque.

19. Define slip in an IM?

The slip of an IM is defined as the ratio of difference between sync. speed (N_s) and rotor speed (N) to the sync. speed.
 $s = (N_s - N) / N_s$

20. Define slip speed in an IM?

The slip speed is defined as the difference in speed between the rotating magnetic field produced by stator (N_s) and rotor speed (N).

21. What is the speed of the rotor field in space?

The speed of the rotor field in space is speed of rotating field. 86. What is sync. speed in 3-phase IM?

$$N_s = 120f/p$$

Where f- supply frequency P- No of poles on the stator.

22. List the various methods of speed control of 3 phase IM? Types of stator side control

1. Stator voltage control
2. Stator frequency control
3. v/f control
4. pole changing method

23. In which type of motor can resistance be introduced in the rotor circuit? What is the effect of it?

Slip ring IM. Effects:

1. starting torque increased
2. starting current decreased
3. motor speed can be controlled

24. Why the slots on the IM are usually skewed?

In order to obtain a uniform torque, reduce the magnetic locking of the stator and rotor and reduce the magnetic humming noise while running.

25. What will be the effect when stator voltage and freq of a IM are reduced proportionally?

1. Motor speed increases
2. Maximum torque is constant

26. What is slip power recovery scheme?

Slip power can be returned to the supply source and can be used to supply an additional motor which is mechanically coupled to the main rotor. This type of drive is known as slip power recovery system and improves overall efficiency of the system.

PART-B

1.Explain the principle, construction, working of an 3-phase induction motor. And also explain the following rotors (i) Squirrel cage Induction Motor (ii) Phase wound Rotor. Mention some of the advantages of three phase induction motor.

2. Explain the principle operation of three phase induction motor. And also explain the following terms (i) Frame (ii) Stator and Rotor Core (iii) Stator and Rotor Windings (iv) Air gap (v) Shaft and bearing (vi) Slip ring enclosure (vii) Fans.

3. Draw the Equivalent circuit diagram for a Three phase Induction Motor and at any slip. And also explain (i) Equivalent circuit of the rotor (ii)Transformer Equivalent circuit for Induction Motor.

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4. How the single phase Induction Motor is started?
(i) Split phase Induction Motor (ii) Capacitor Induction Motor (iii) Shaded Pole Induction Motor.
 5. Explain the Double revolving field theory how it is applicable for a Single phase Induction Motor.
 6. With neat sketch, explain the principle, construction, working and types of a three phase alternator.
 7. Explain the following terms in three phase alternator (i) Equation of induced emf (ii) Voltage Regulation (iii) Types.
 8. What is meant by Synchronous motor ? Obtain the formulae for Synchronous speed. And also explain the different methods for starting of synchronous motor.
 9. In synchronous Motor explain the following terms (i) Torque Equation (ii) V-Curve Characteristics.
 10. A 50 Hz, 4-pole,3-phase induction motor has a rotor current of frequency 2 Hz. Determine (i) Slip (ii) Speed of Motor.
 11. The input power to a 6 pole,3 phase,50 HZ Induction motor is 42 KW;the speed is 970 r.p.m.The stator losses are 1.2KW and the friction and windage losses 1.8 kw.find (i)the rotor cu loss(ii)the efficiency of the motor.
 12. A 1500KVA,6.6KV,3 phase, star connected alternator has a resistance of 0.5 Ω /phase and a synchronous reactance of 5 Ω /phase. find its voltage regulation for (i) unity p.f(ii) 0.8 p.f lagging

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SYNCHRONOUS AND SPECIAL MACHINES**PART – A**

1. 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.

2. What are the advantages of salient type pole construction used in sync.machines?

They allow better ventilation, the pole faces are so shaped radial air gap length increases from pole center to pole tips so flux distortion in air gap is sinusoidal so emf is also sinusoidal.

3. Which type of sync. generators are used in hydroelectric plants and why? As the speed of operation is low, for hydro turbines used in hydroelectric plants, salient pole type sync. generator is used because it allows better ventilation also better than smooth cylindrical type rotor

4. Why are alternators rated in KVA and not in KW?

As load increases I^2R loss also increases, as the current is directly related to apparent power delivered by generator, the alternator has only their apparent power in VA/KVA/MVA as their power rating.

5. Why the sync. impedance method of estimating voltage regulation is considered as pessimistic method?

Compared to other method, the value of voltage regulation obtained by this method is always higher than the actual value so it is called as pessimistic method.

6. Why MMF method of estimating voltage regulation is considered as optimistic

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method?

Compared to EMF method, MMF method involves more no. of complex calculation steps. Further the OCC is referred twice and SCC is referred once while predetermining the voltage regulation for each load condition. Reference of OCC takes core saturation effect. As

this method require more effort, final result is very close to actual value, hence this method is called as optimistic method.

7. Define voltage regulation of the alternator?

It is defined as the increase in terminal voltage when full load is thrown off, assuming field current and speed remaining the same.

$$\% \text{ reg} = [(E_0 - V)/V] \times 100$$

Where E_0 = no terminal voltage V = full load rated terminal voltage

8. How is arm. winding in alternators is different from those used in dc machines?

The arm. winding of the alternator is placed in the stator, but in the case of dc machines the arm winding is placed in the rotor.

9. What is hunting how can it be prevented?

When a sync motor is used for driving a fluctuating load, the rotor starts oscillating about its new position of equilibrium corresponding to the new load. This is called hunting or phase swinging. To prevent hunting dampers are damping grids are employed.

10. what are different torques of a sync motor?

1. Starting torque
2. Running torque
3. Pull-in torque
4. Pull-out torque

11. define step angle?

It is defined as angle through which the stepper motor shaft rotates for each command pulse. It is denoted as θ , $\theta = [(N_s - N_r) / N_s \cdot N_r] \times 360^\circ$

Where N_s = no. of stator poles or stator teeth N_r = no. of rotor poles or rotor teeth

$$\theta = 3600 / m N_r$$

Where m = no. of stator poles

12. What are different types of stepper motor?

1. Variable reluctance (VR) motor
2. Permanent magnet (PM) stepper motor
3. Hybrid stepper motor

13. What is the advantage in using stepper motor?

1. it can drive open loop without feedback
2. it requires little or no maintenance.

14. Give the applications of stepper motor?

1. Robotics
 2. Computer peripherals
 3. Facsimile machine
 4. Aerospace
15. What are the adv. of reluctance m/c?
1. Motor speed is constant
 2. Simple construction

UNIT 4
Part A

BASICS OF MEASUREMENT AND INSTRUMENTATION

1. Distinguish between static and dynamic characteristics.
Static characteristics of a measurement system are those that are considered when the system or instrument is used to measure a condition not varying with respect to time
Dynamic characteristics of a measurement system are those that are considered when the system or instrument is used to measure a condition varying with respect to time performance criteria based upon dynamic relation.
2. Compare accuracy and procession.
Accuracy is the closeness with which an instrument reading approaches the true value of the quantity being measured, thus accuracy of the measurement means conformity to the truth
Precession is a measure of the reproducibility of the measurement i.e, given a fixed value of a quantity; precession is the measure of the degree of agreement within group of measurements, the term precise means clearly or sharply defined
3. Define the term resolution.
If the input is slowly increased from some arbitrary input value it will again be found that output does not change at all until a certain increment is exceeded or it is the smallest measurable input change
4. Define static sensitivity of an instrument
It is the ratio of the magnitude of the output signal or response to the magnitude of the input signal or the quantity being measured
5. How linearity of the transducer is is being measured?
Linearity is the measure of the maximum deviation of the plotted transducer response from a specified response from a specified straight line. Higher the meter resistance betters the linearity on other hand linearity can be improved by providing low pot resistance but it will affects the sensitivity of the measurement.
6. State any two dynamic characteristics of transducers.

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- Speed of response , measuring lag, fidelity, dynamic error
7. State the various types errors.
Gross errors, systematic errors, random errors
 8. Give the types of systematic errors.
Instrumental error, environmental error observational error
 9. What are the two methods for achieving variations in inductance? Variation of self inductance
Variation in mutual inductance. 10. State piezoelectric effect.

A piezoelectric material is one in which an electric potential appears across certain surfaces of a crystal if the dimensions of the crystal are changed by the applications of a mechanical forces, this potential is produced by the displacement of charges the effect is reversible is applied to the proper axis of the crystal. It will change its dimensions of the crystal, thereby deforming it . This effect is known as piezo electric effect

UNIT 5
PART A
ANALOG AND DIGITAL INSTRUMENTS

1. Give the applications of measurement systems
 1. monitoring of processes and operations
 2. control of process and operations
 3. experimental engineering analysis
2. What are the different types of DVM The DVM are broadly classified into
 1. non integrating type
 2. integrating type
3. Name the list of non integrating types Potentiometric type
Ramp type
4. Name the list of potentiometric type. Successive approximation type Null balance type
5. Name the list of ramp type 1. Linear type
2 stair case type
6. name the list of integrating type DVM 1. Voltage To Frquency Type

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2. potentiometric type 3.dual slope integrating type
7. what are the advantages of successive approximation type DVM? Resolution upto 5 significant digit is possible
Very high speed of order of 100 reading per second is possible Accuracy is high
- . what are the disadvantages of successive approximation type DVM the circuit is complex
the input impedance is variable the DAC is also required
- 8 . what is the principle of ramp type digital voltmeter?
the operating principle of ramp type digital voltmeter is to measure the time that a linear ramp voltage takes to change from level of input voltage to zero voltage . this time interval is measured with an electronic time interval counter and the counter is displayed as a number of digits on electronic indicating tubes of the output read out of the voltmeter
- 9 . what are the advantages of ramp type DVM the circuit is easy to design
the input signal is converted to time , which is easy to digitize by adding external logic , the polarity of the input also can be displayed
- 10 . define the digital multi meter
it is an instrument which is capable of measuring AC voltages DC voltages AC current DC current and resistances over several miles
- 11 .Name the two different type of storage oscilloscope
1. mesh storage
2. phosphor storage
- 12 . define storage oscilloscope
the cathode ray tube has the persistence of the phosphor ranging from the few milli second to several seconds, but sometimes it is necessary to retain the image or much longer periods, upto several hours, it requires storing of a waveform for certain duration independent of phosphor persistence such as retention property helps to display the waveforms of very low frequency
- 13 .define bridge circuits.
A bridge circuit in simple form consists of a network of four resistances arms forming a closed circuit. A source of current is applied to two opposite junctions the current detector is connected to other two junctions. the bridge circuit uses the comparison measurement method and operate on null indication principle.

14 .list the DC bridges wheat stone bridge Kelvin bridge

15 .list the AC bridge

capacitance comparison bridge inductance comparison bridge maxwells bridge

hay s bridge Andersons bridge Schering bridge Wein bridge

16 .what is meant by wheat stone bridge

it is an instrument for making comparison measurements and operates upon a null indication principle . this means that the indication is independent of the calibration of the null indicating instrument or any of its characteristics

17 .what are the applications of wheat stone bridge

the wheat stone bridge is basically a DC bridge and used to measure the resistance in thr range 1 r to 100 mega ohms

it is used to measure DC resistances of various types of wires for the purpose 0of quality of control.

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