EE 223 (R-20)

Total No. of Questions : 10] [Total No.of Pages : 03

II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

Second Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL MACHINES - II

Time : **Three Hours** Maximum : **70** Marks

Answer ONE question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. a) What is rotating magnetic field ? Explain how it is produced when the windings are displayed by 90 degrees.

   b) Explain, why the speed of 3-phase induction motor cannot be equal to synchronous speed ?

(OR)

2. a) Explain how the rotating magnetic field is created in three phase induction motor.

   b) Why is a rotating field system used in preference to a stationary field ?

UNIT - II

3. a) Draw the torque-slip characteristics of a 3-phase induction motor. Explain them briefly.

   b) A 20 kW, 6 pole, 400 V, 50 Hz, 3 Phase induction motor has a full load slip of 0.02. If the torque lost in mechanical losses is 20 Nm, find the rotor ohmic losses, motor input and efficiency. Stator losses are 900 watts.

(OR)

4. a) Describe the principle of operation of three phase induction motor. Explain why the rotor is forced to rotate in the direction of rotating magnetic field.

   b) A 3-phase, 4-pole, 50 Hz, induction motor has a star connected wound rotor. The rotor emf is 50V between the slip rings at standstill. The rotor resistance and standstill reactance are 0.4Ω and 2.0Ω respectively. Calculate (i) rotor current per phase at starting when slip rings are short circuited (ii) Rotor current per phase at starting if 50Ω per phase resistance is connected between slip rings (iii) Rotor EMF when the motor is running at full load at 1440 rpm.

P.T.O.

UNIT - III

5. a) Draw and explain the torque - slip characteristic of a single-phase induction motor on the basis of Double-revolving field theory.

   b) Compare between capacitor start motors and split phase motors.

(OR)

6. a) Discuss the various applications of single-phase motors.

   b) Explain the constructional details and principle of operation of a split phase induction motor. List out its industrial applications.

UNIT - IV

7. a) Derive an emf expression of an alternator from fundamentals showing clearly the expressions for pitch and distribution factors. Also derive the ratio of induced emfs of nth harmonic to fundamental.

   b) What is armature reaction ? Explain the effect of armature reaction on the terminal voltage of an alternator at ZPF lag and ZPF lead with the help of necessary phasor diagram ?

(OR)

8. a) What are the applications of synchronous generators ? Explain the constructional details of a salient pole synchronous generator.

   b) The phase emf of a 3 phase, 50 Hz alternator consists of a fundamental, a 20% third harmonic and a 10% fifth harmonic. The amplitude of the fundamental voltage is 1000V. Calculate the rms line voltage when the alternator windings are in (i) Star and (ii) Delta.

UNIT - V

9. a) What are the differences between synchronous motor and induction motor ? Explain the operation of synchronous motor with variable excitation at constant load ?

   b) Explain the effect of variation of excitation and mechanical input on the parallel operation of alternators with necessary phasor diagrams ?

(OR)

10. a) What is synchronous condenser ? What are the advantages of installing a synchronous condenser in an electrical system ? Illustrate your answer with an example ?

b) A 3 phase, 500 V, synchronous motor draws a current of 50 A from the supply while driving a certain load. The stator is star connected with armature resistance of 0.4 Ω/ph and a synchronous reactance of 4Ω/ph. Find the power factor at which the motor would operate when the field current is adjusted to give the line emf of 600V.