

# All parts of the question must be answered in one place only

# MODULE - I

- 1. (a) Illustrate the construction of squirrel cage induction motor with a neat diagram. State the merits and demerits of squirrel cage and slip ring induction motor. [BL: Understand] CO: 1|Marks: 7]
  - (b) A 3 phase, 400 V, 50 Hz, 4 pole induction motor has star-connected stator winding. The rotor resistance and reactance are  $0.1\Omega$  and  $1\Omega$  respectively. The full load speed is 1440 rpm. Calculate the torque developed on full load by the motor. Assume stator to rotor ratio a 2:1.

[BL: Apply] CO: 1|Marks: 7]

#### $\mathbf{MODULE}-\mathbf{II}$

- 2. (a) Classify various losses that occur in an induction motor. Explain how they vary with frequency voltage and load. [BL: Understand] CO: 2|Marks: 7]
  - (b) Draw the circle diagram for a 20 HP, 50 Hz, 3 phase, star connected induction motor with the following data.

No load test: 400 V, 9 A, 0.2 p.f lagging.

Blocked rotor test: 200 V, 50 A, 0.4 p.f lagging

Determine the line current, efficiency and slip for full load condition from the circle diagram.

[BL: Apply] CO: 2|Marks: 7]

## $\mathbf{MODULE}-\mathbf{III}$

- 3. (a) Demonstrate in detail about the construction and working of a 3-phase alternator with neat sketch. [BL: Understand] CO: 3|Marks: 7]
  - (b) A 3-Phase, 16 pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency rpm and the phase and line e.m.f. Assume full-pitched coil.

[BL: Apply| CO: 3|Marks: 7]

4. (a) Discuss in detail the effect of harmonics on pitch and distribution factors with neat diagrams.

[BL: Understand| CO: 4|Marks: 7]

(b) Find the no-load phase and line voltage of a star connected 3-phase, 6-pole alternator which runs at 1200 rpm, having flux per pole of 0.1 Wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot.

[BL: Apply| CO: 4|Marks: 7]

## $\mathbf{MODULE}-\mathbf{IV}$

- 5. (a) Discuss in detail about the construction of three phase synchronous motor. List the applications of synchronous motor. [BL: Understand] CO: 5|Marks: 7]
  - (b) A 400 V, 3 phase, star connected synchronous motor has an armature resistance of  $0.2\Omega$  per phase and synchronous reactance of  $2\Omega$  per phase. While driving a certain load, it takes 25 A from the supply. Calculate the back emf induced in the motor if it is working with
    - i) 0.8 lagging
    - ii) 0.9 leading
    - iii) Unity power factor condition.

- [BL: Apply| CO: 5|Marks: 7]
- 6. (a) Describe the torque-angle characteristics of synchronous motor with neat diagram and illustrate pill-in and pull-out torque. [BL: Understand] CO: 5|Marks: 7]
  - (b) The input power to 6.6 kW, 3 phase star connected synchronous motor is 900 kW. The synchronous reactance is  $20 \Omega$ /phase and the resistance is negligible. if the generated voltage is 8.6 kV, calculate the motor current and its power factor. [BL: Apply] CO: 5|Marks: 7]

# $\mathbf{MODULE}-\mathbf{V}$

- (a) Summarize double revolving theory as applied to a single phase induction motor and prove that it cannot produce any starting torque.
  [BL: Understand] CO: 6|Marks: 7]
  - (b) The equivalent impedances of the main and auxiliary windings in a capacitor motor are  $(15+j22.5)\Omega$ . and  $(50+j120)\Omega$  respectively, while the capacitance of capacitor is  $12 \ \mu$ F. Determine the line currents at starting on a 230 V, 50 Hz supply. [BL: Apply] CO: 6|Marks: 7]
- 8. (a) Explain construction, working and applications of shaded pole induction motor with neat diagrams. [BL: Understand| CO: 6|Marks: 7]
  - (b) A 250 watts ,230 V ,50 Hz, single phase capacitor start induction motor has the following constants for the main and auxiliary windings. Main winding  $Z_m = (4.5+j3.7)\Omega$ , auxiliary winding  $Z_a = (9.5+j3.5)\Omega$ . Determine the value of the capacitor that will place the main and auxiliary winding currents in quadrature at starting. [BL: Apply] CO: 6|Marks: 7]

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