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Puran

02/05/25

B. Tech-4th (EE)
Electrical Machines-II

Full Marks : 50

Time : $2\frac{1}{2}$ hours

Answer all questions

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

1. Answer *all* questions : 2 × 5

(a) What type of rotor is adopted for high speed alternators ? What will be the number of poles of a 50 Hz alternator if it runs at its greatest speed ?

(b) What is meant by hunting of synchronous motor ? How will you minimize it ?

(c) State the conditions necessary for paralleling alternators ?

(Turn Over)

(2)

(d) What does crawling of induction motor mean ?

(e) What is universal motor ? Why is it so called ?

2. (a) Derive the equation of induced EMF for an alternator. 4

(b) Find the no-load phase and line voltage of a star connected three 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 short by one slot. 4

Or

What is meant by "armature reaction" of a synchronous machine ? What are the relations of armature reaction and power factor of a synchronous machine ? Explain with relevant diagram considering different cases. 8

(3)

3. (a) Derive an expression for power developed in a non salient pole alternator. 4

(b) A non-salient pole synchronous generator having synchronous reactance of 0.8 p.u. is supplying 1 p.u. power to a unity power factor load at a terminal voltage of 1.1 p.u. Determine the power angle. Neglect armature resistance. 4

Or

(a) Explain the two reaction theory of salient pole alternator and draw its phasor diagram for lagging power factor load. 4

(b) Describe the slip test method-for the measurement of X_d and X_q of synchronous machines. 4

4. Explain the effects of varying excitation on armature current and power factor in a synchronous motor. Draw V and Λ curves. 8

(4)

Or

- (a) With neat diagram explain the operation of synchronous motor and justify statement 'synchronous motor is not self-starting'. 4
- (b) A three phase 150kW, 2300V, 50Hz, 1000-rpm salient pole synchronous motor has $X_d = 32\Omega/\text{phase}$ and $X_q = 20\Omega/\text{Phase}$. Neglecting losses, calculate the torque developed by the motor if field excitation is so adjusted as to make the back EMF twice the applied voltage and $\alpha = 16^\circ$. 4
5. (a) Describe with a neat diagram, the principle of operation of induction generator. 4
- (b) Develop the equivalent circuit of a poly phase induction motor. Explain how this equivalent circuit is similar to the transformer equivalent circuit? 4

(5)

Or

- (a) Explain how a rotating magnetic field is produced in a three-phase induction motor. 4
- (b) A three phase induction motor run at a speed of 950 rpm at full load when supplied with power from a 50Hz three phase line. The synchronous speed is 1000 rpm. Determine,
- (i) The number of poles of the motor.
 - (ii) What is the percentage slip at full load ?
 - (iii) What is the corresponding frequency of rotor voltages ?
 - (iv) What is the rotor frequency at the slip of 10 percent ? 4
6. Explain two field revolving theory for single phase induction motor and give its Torque-Slip characteristics. 8

(6)

Or

- (a) Explain shaded pole motor working principle with neat circuit diagram. 4
- (b) What is a repulsion motor ? Explain with suitable diagram. 4
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