Reg. No. : | | | | | | | | | | | |

D 4169

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1251 — ELECTRICAL MACHINES – II

(Common to B.E. (Part-Time) Third Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Specify the condition beyond which the synchronous machine is said to be out-of-step?

2. What is the significance of having dc field rotating in synchronous machine?

3. What are the causes of Hunting?

4. What is meant by break out torque?

5. A 3-phase, 50Hz, induction motor has 2 poles. If the slip is 2 percent at a certain load, determine the speed of the rotor.

6. Mention some of the applications of 3-phase induction motor.

7. In what ratio starting line current and starting torque are reduced with star-delta starting.

8. What is the effect of change in supply voltage on starting torque?

9. What is a repulsion motor?

10. Draw the schematic diagram to illustrate the reversal of a split-phase motor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain and derive the expression for distribution factor and coil span factor. (10)

(ii) A 3phase, 50Hz, 16pole star connected alternator has a stator winding with 144 slots with 10 conductors/slot. The magnetic flux/pole is 0.03 webers and is sinusoidally distributed in space. The coil pitch of the winding is 8 slots. Estimate the emf induced between the lines of the alternator. (6)

Or

(b) (i) Explain the potier reactance method of determining regulation of an alternator. (8)

(ii) A 20MVA, 3phase star connected alternator with an impedance of 5 Ω and a resistance of 0.5 Ω is operating in parallel with constant voltage 11KV busbars. If its field current is adjusted to give an excitation voltage of 12KV, calculate :

(1) the maximum power output from the alternator and

(2) the power factor under maximum conditions. (4 + 4)

12. (a) (i) Derive the expression for the power developed by the synchronous motor when connected to infinite bus. (8)

(ii) A 9KW, 400V three phase star connected synchronous motor has synchronous impedance per phase of (0.4 + 3j) Ω. Find the angle of retard and the voltage to which the motor must be excited to give a full-load output at 0.8 leading power factor. Assume an efficiency of 90%. (8)

Or

(b) (i) Explain how the current locus of a synchronous motor developing constant power is a circle. (8)

(ii) A 3phase 11000V, star connected synchronous motor takes a load of 100A. The effective synchronous reactance and resistance per phase are 30 Ω and 0.8 Ω respectively. Find the power supplied to the motor and the induced EMF for

(1) 0.8 PF lag

(2) 0.8 PF lead. (4 + 4)

13. (a) (i) Explain briefly how slip-frequency currents are setup in the rotor bars of a 3-phase induction motor and why this frequency varies with load. (8)

(ii) A 415V, 3phase, 50Hz, 4 pole, star connected induction motor runs at 24rev/s on full load. The rotor resistance and reactance per phase are 0.35 ohm and 3.5 ohm respectively, and the effective rotor-stator turns ration is 0.85 : 1. Calculate :

(1) slip,

(2) the full load torque,

(3) the power output if the mechanical losses amount to 770W,

(4) the maximum torque,

(5) the speed at which the maximum torque occurs, and

(6) the starting torque. (8)

Or

(b) The following data refers to a 12pole, 420 V, 50Hz, three phase mesh connected induction motor :

$r_1 = 2.95\,\Omega$, $x_1 = 6.82\,\Omega$, $r_2' = 2.08\,\Omega$, $x_2' = 4.11\,\Omega$ per phase.

On no load, the line value of magnetizing current is 6.7A and the total core loss is 269W. Determine the power factor, input current, equivalent rotor current and torque developed by the motor at a slip of 3% using exact equivalent circuit.

Determine the maximum torque developed and the corresponding speed. (16)

14. (a) Discuss with connection diagram the working of Direct-on-line starting of an induction motor. Also derive the expression for the torque developed on starting. (16)

Or

(b) (i) Explain any TWO methods of speed control of induction motor. (8)

(ii) An 8 pole, 50 Hz, 3phase induction motor is running at 4% slip when delivering full load torque. It has standstill rotor resistance of $0.1\,\Omega$ and reactance of $0.6\,\Omega$ per phase. Calculate the speed of the motor if an additional resistance of $0.5\,\Omega$ per phase is inserted in the rotor circuit. Assume full load torque remains constant. (8)

15. (a) (i) What are the different types of single phase induction motor? (4)

(ii) Explain the principle of operation and constructional feature of shaded pole induction motor. (12)

Or

(b) Explain with suitable diagram the working and speed-torque characteristics of single phase induction motor starting by resistance start motor method. (16)

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