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10EE54

Fifth Semester B.E. Degree Examination, June/July 2018

DC Machines and Synchronous Machines

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Derive the e.m.f. equation of a d.c. generator. (06 Marks)
- b. Define commutation. Explain the process of commutation in d.c. generators with neat sketches. (07 Marks)
- c. A 4-pole, 50 KW, 250 V wave-wound shunt generator has 400 armature conductors. Brushes are given a lead of $36/5$ degrees. Calculate the demagnetizing amp-turns/pole if shunt field resistance is 50Ω . Also calculate extra shunt field turns/pole to neutralize the demagnetization. (07 Marks)
- 2 a. Explain what is meant by back emf. Explain the principle of torque production in a d.c. motor. (05 Marks)
- b. Explain with neat sketch, the working of three point starter. (05 Marks)
- c. Discuss two methods of speed control of d.c. shunt motor. (05 Marks)
- d. A d.c. motor takes an armature current of 110 A at 480 V. The armature circuit resistance is 0.2 ohm. The machine has 6-poles and armature is lap connects with 864 conductors. The flux per pole is 0.05 wb. Calculate: (i) speed (ii) torque developed by the armature. (05 Marks)
- 3 a. What are the losses that occur in d.c. machines? Derive the condition for maximum efficiency. (05 Marks)
- b. Explain briefly Hopkinson's test for determination of efficiency of d.c. shunt machines. (08 Marks)
- c. When running on no load, a 400 V, shunt motor takes 5A. Armature resistance is 0.5 ohm and field resistance 200Ω . Find the efficiency when running on full load and taking full load current of 50A. (07 Marks)
- 4 Write short notes on:
 - a. External characteristics of D.C. shunt, series and compound generators.
 - b. D.C. motor applications
 - c. Power flow diagram in d.c. machine
 - d. Field test
 (20 Marks)

PART – B

- 5 a. Explain the phenomena of armature reaction when alternator delivering to upf, lagging power factors, leading power factor load. (07 Marks)
- b. Draw the phasor diagram of a loaded generator for the following conditions:
 - i) Lagging power factor
 - ii) Leading power factor
 - iii) UPF
 (06 Marks)
- c. A 3-phase, 50 Hz, 2-pole, star connected alternator has 54 slots with 4 conductors per slot. The pitch of the coil is 2 slots less than the pole pitch. If the machine gives 3300 V between lines on open circuit with sinusoidal flux distribution, determine the useful flux per pole. (07 Marks)

- 6 a. Explain the mmf method of determining the voltage regulation of alternator. (07 Marks)
b. Describe the slip test method for the measurement of X_d and X_q of synchronous machine. (05 Marks)
c. A 100 KVA, 3000 V, 50 Hz, 3-phase star connected alternator has effective armature resistance of 0.2 ohm. The field current of 40 A produces short circuit current of 200 A and open circuit emf of 1040 V (line). Calculate the full load voltage regulation at 0.8 p.f. lag and lead. (08 Marks)
- 7 a. For a cylindrical rotor synchronous machine, neglecting the effect at armature resistance, derive an expression for power developed as a function of load angle. (06 Marks)
b. What is the capability curve of a synchronous generator? What informations are available from this curve? (07 Marks)
c. A 2 MVA, 3-phase, 8-pole alternator is connected to 6000 V, 50 Hz bus bars and has a synchronous reactance of 4Ω per phase. Calculate the synchronizing power and the synchronizing torque per mechanical degree of rotor displacement at no load. Assume normal excitation. (07 Marks)
- 8 a. Describe briefly the effect of varying excitation upon armature current and power factor of a synchronous motor, when input power to the motor is maintain constant. (07 Marks)
b. Why is synchronous motor not self starting and what methods are generally used to start the synchronous motor? (07 Marks)
c. Explain hunting of synchronous machine. What is the purpose of damper windings in a synchronous machine? (06 Marks)

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