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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 50 Ω. 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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