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06EE54

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. What is armature reaction in dc machine? Explain how armature reaction produces cross magnetization and demagnetization effect. (10 Marks)
- b. A 230 V dc shunt machine has armature circuit resistance (including brushes) of 0.5Ω and field circuit resistance of 115Ω . If this machine is connected to 230 V supply mains, find the ratio of speed as a generator to the speed as a motor. The line current in each case is 40 A. (10 Marks)
- 2 a. What is back emf? What is its significance? (05 Marks)
- b. Obtain an expression for the torque developed by a dc motor. (05 Marks)
- c. With the help of a neat diagram, explain the ward leopard method of speed control. (10 Marks)
- 3 a. A series motor with an unsaturated magnetic circuit and 0.5Ω total resistance, when running at a certain speed takes 60 A at 500 V. If the load torque varies as the cube of the speed, calculate the resistance required to reduce the speed by 25%. (08 Marks)
- b. With a neat circuit diagram, explain the procedure to conduct Hopkinson's test. Show how efficiencies of motor and generator are calculated. (12 Marks)
- 4 a. A 500 V shunt motor takes 4A on no load. The armature resistance including that of brushes is 0.2Ω and the field current is 1A. Estimate the output and the efficiency when the input current is (i) 20A (ii) 100A. (10 Marks)
- b. Discuss the principle of operation and applications of permanent magnet DC motor. (06 Marks)
- c. Draw the power flow diagram of a dc generator and a dc motor. (04 Marks)

PART - B

- 5 a. What is pitch factor and distribution factor? Explain. (06 Marks)
- b. Derive an expression for emf induced in an alternator including the effect of pitch factor and distribution factor. (06 Marks)
- c. A 3 phase, 50 Hz, 2 pole, star connected turbo 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 the lines on open circuit with sinusoidal flux distribution, determine the useful flux per pole. (08 Marks)
- 6 a. Describe the synchronous impedance method to determine voltage regulation of an alternator for lagging and leading power factor. (12 Marks)
- b. A 2300 V, 50 Hz, 3 phase, star connected alternator has an effective armature resistance of 0.2Ω . A field current of 35A produces a current of 150A on short circuit and an open circuit emf 780 V (line). Calculate the voltage regulation at 0.8 pf lagging and 0.8 pf leading for the full load current of 25A. (08 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 7 a. What do you mean by synchronization of alternators? List the conditions to be fulfilled to connect two alternators in parallel. (05 Marks)
- b. Why synchronous motors are not self starting? Mention the methods by which synchronous motors are started in practice. (07 Marks)
- c. Explain the phenomenon of hunting in synchronous machines and the method of reducing the same. (08 Marks)
- 8 a. With a neat circuit diagram, explain the method of conducting slip test on salient pole synchronous machine and indicate how X_d and X_q can be determined from the test. (08 Marks)
- b. A salient pole synchronous machine with 4-pole ac winding is coupled to a prime-mover. The machine is running at a speed of 1490 rpm. The synchronous machine stator is excited with a current of 50 Hz frequency. Rotor winding of the machine is open. Per phase voltage and current for phase A of the machine are 30V, 25V, 10A and 6.5A. Armature resistance is negligible. The name plate rating of the machine is 20 MVA, 3 phase, star connected, 11 KV, 50 Hz. At full load unity pf and rated voltage, calculate:
- The excitation voltage and
 - The reluctance power developed by the machine
- (12 Marks)

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