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Fifth Semester B.E. Degree Examination, June-July 2009
DC Machines & Synchronous Machines

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1
 - a. Explain the various causes for the failure of a dc shunt generator to build up the voltage. (05 Marks)
 - b. Explain with neat sketches how armature reaction results into demagnetization and cross-magnetization effects. Derive expression for demagnetizing and cross-magnetizing ampere-turns. (10 Marks)
 - c. A 4-pole, wave wound, dc machine running at 1500 rpm has commutator of 30cm diameter. If armature current is 150A, thickness of brush 1.25cm and the self-inductance of each armature coil is 0.07mH, calculate the reactance voltage during commutation. Assume linear commutation and neglect mica thickness. (05 Marks)

- 2
 - a. With the help of characteristics, explain what happens if (i) a dc series motor is started without mechanical load on it and (ii) a dc shunt motor is started with mechanical load on it. (06 Marks)
 - b. What is back emf? Explain its significance in the operation of a dc motor. (06 Marks)
 - c. A 220V series motor in which the total armature & field resistance is 0.1Ω is working with unsaturated field taking 100A & running at 800 rpm. Calculate at what speed the motor will run when developing half the torque. (08 Marks)

- 3
 - a. List the different losses in a dc machine. How do they vary with load? Derive a condition for maximum efficiency. (08 Marks)
 - b. The Hopkinson's test on two shunt machines gave the following results for full load:
 Line voltage = 250V; Current taken from supply system excluding field current = 50A;
 Motor armature current = 380A; Field currents = 5A & 4.2A (gen. & mot. respectively)
 Calculate the efficiency of motor and generator. Assume armature resistance of each machine is 0.02Ω . (12 Marks)

- 4
 - a. Derive an expression for emf induced in an alternator including the effect of winding factors. Also derive expressions for pitch factor and distribution factor. (10 Marks)
 - b. A 3-phase, 8-pole, 750 rpm alternator has 72 slots. Each slot has 12 conductors and winding is short-pitched by two slots. Find pitch factor and breadth factor. If flux per pole is 0.06Wb, find induced emf per phase. (10 Marks)

- 5
 - a. Define voltage regulation of an alternator and explain ZPF-method of determining it and compare this method with other known methods. (10 Marks)
 - b. A 3-phase, 6000V alternator has the following OCC at normal speed:

Field current, amps :	14	18	23	30	43
Terminal voltage (Line value):	4000	5000	6000	7000	8000

 With armature short circuited and full load current flowing, the field current is 17A and when the machine is supplying full load of 200kVA at zero power factor, the field current is 42.5A and the terminal voltage is 6000V. Determine the field current required when the machine is supplying full load 0.8PF lag by ZPF method. (10 Marks)

- 6 a. Derive an expression for the power output of a salient pole alternator and hence explain "reluctance power". (10 Marks)
- b. Explain the phenomenon of 'Hunting' in synchronous machines and the method of reducing the same. (10 Marks)
- 7 a. With a neat circuit diagram, explain slip test on salient pole synchronous machine and indicate how X_d & X_q can be determined from the test. (10 Marks)
- b. Discuss the effect of
- i) Change in excitation and
 - ii) Change in input power.
- when alternators are running in parallel. (10 Marks)
- 8 Write short notes on any FOUR:
- a. \vee & \wedge curves of a synchronous motor.
 - b. Permanent magnet DC motor.
 - c. Two reaction theory.
 - d. Synchronous condenser.
 - e. Use of interpoles and compensating windings in a DC machine. (20 Marks)
