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10EE54

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
DC Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting atleast TWO questions from each part.***
2. Draw figures and phaser diagrams wherever necessary.

PART – A

1 a. Derive the emf equation of a DC generator. **(06 Marks)**
b. What is a critical field resistance of a shunt generator? How is it determined? **(08 Marks)**
c. Discuss the reasons why sometimes a self excited shunt generator does not build up voltage. **(06 Marks)**

2 a. Explain the principle of operation of a DC motor highlighting how power transfer takes place in it. **(06 Marks)**
b. Derive an expression for the torque developed in a DC motor. **(06 Marks)**
c. A 250 V DC shunt motor on no load runs at 1000 rpm, and takes 5A. The armature and shunt field resistance are 0.2 ohm and 250 ohm respectively. Calculate the speed when the motor is loaded and takes a current of 50 Amp if the armature reaction weakens the filed by 3%. **(08 Marks)**

3 a. Explain in detail, the various losses in a DC machine. **(06 Marks)**
b. Draw and explain the power flow diagrams of generator and motor. **(06 Marks)**
c. Define efficiency and drive the condition for maximum efficiency. **(08 Marks)**

4 a. With a neat figure, explain the Hopkinson's test on a pair of identical DC machines. How is the efficiency determined when the machine is functioning as a motor? **(06 Marks)**
b. Describe the relative merits and demerits of Swinburne's test. Why this test cannot be performed on a series machine? **(06 Marks)**
c. A DC shunt machine takes 5A when run as a motor on no load from a 400 V supply. The armature and field resistance are 0.5 and 200 ohm respectively. Determine the efficiency of the machine as a generator supplying 50 A at 400 V. **(08 Marks)**

PART – B

5 a. What are the advantages of rotating field construction in alternator? **(04 Marks)**
b. Derive the emf equation of an alternator. Discuss the effect of pitch factor and distribution factor on the generated voltage. Derive expression for pitch factor and distribution factor. **(08 Marks)**
c. A 3 phase star connected alternator on open circuit is required to generate a line voltage of 3.4 kV, 50 Hz when driven at 500 rpm. The stator has 3 slots/pole/ph and 10 conductors/slot. The coils are short chorded by 1 slot. Calculate the number of poles and useful flux/pole. **(08 Marks)**

6 a. Explain the phenomenon of armature reaction in alternator while supplying lagging p.f. loads. **(04 Marks)**

b. Describe the m.m.f method of predetermining the regulation of an alternator i) at u.p.f. load ii) at lagging p.f load. **(08 Marks)**

c. A 3 phase, 4 pole star connected alternator has a smooth cylindrical type rotor. The effective resisitance and synchronous reactance per phase are 0.15 ohm and 2.5 ohms respectively. Calculate the voltage regulation when delivering 250 amps, at 6.6 KV and 0.6 p.f lagging. **(08 Marks)**

7 a. With necessary figures and phasor diagrams, explain the Blondel's two reaction theory as applicable to salient pole alternators. **(08 Marks)**

b. Discuss the steps taken to ensure the sharing of active and reactive loads in properties to their ratings between two or more alternator sets operating in parallel. **(06 Marks)**

c. Two alternators operating in parallel supply a lighting load of 2000 kW and motor loads aggregating 6000 KW at 0.707 p.f. lagging. Find the power delivered and 1 p.f. of the second alternator, if one alternator is loaded to 3600 kW .8 p.f. lag. **(06 Marks)**

8 a. Explain why synchronous motor is not self starting. Discuss one method of starting synchronous motors. **(06 Marks)**

b. Draw and explain the phasor diagram of a synchronous motor and hence obtain an expression for the power developed by a synchronous motor. **(06 Marks)**

c. A synchronous motor developing 20 kW is connected in parallel with a factory load of 200 kW at a p.f. of 0.8 lag. If the total load connected to the supply has a p.f. of 0.92 lag, what is the value of reactive power taken by the motor and at what p.f. is it operating? **(08 Marks)**

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