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06EE54

Fifth Semester B.E. Degree Examination, May/June 2010
D.C. 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? Explain the same for a D.C. generator. **(08 Marks)**

b. Explain what is meant by critical field resistance in a D.C. shunt generator and explain a method of determining it. **(06 Marks)**

c. The brushes of a lap connected 400 kW, 6 pole D.C. generator are given a lead of 21 electrical degrees. From the data given, calculate the demagnetizing and cross magnetizing ampere turns. The full load current is 750 amperes and total number of conductors in the armature is 900. **(06 Marks)**

2 a. Explain the different characteristics of D.C. series motor. **(06 Marks)**

b. With a neat sketch, explain the Ward-Leonard method of speed control of a D.C. shunt motor. What are the advantages and disadvantages of this method? **(08 Marks)**

c. A 230 volts DC shunt motor runs at 800 rpm and takes an armature current of 50 Amperes. Find the resistance to be added to the field circuit to increase the speed from 800 rpm to 1000 rpm at an armature current of 80 Amperes. Assume that fulx is proportional to the field current. Take $R_a = 0.150\,\Omega$, $R_{sh} = 250$ ohms. **(06 Marks)**

3 a. What are the different losses in D.C. shunt motor? How do they vary with load? **(04 Marks)**

b. Explain the process of commutation in D.C. generator and describe any one method of improving commutation. **(08 Marks)**

c. A series motor having a resistance of 1 ohm between its terminals, drives a fan, the torque of which is proportional to the square of the speed. At 230 volts, its speed is 300 rpm and takes 15 amperes current. The speed of the fan is to be raised to 375 rpm by applying voltage control. Estimate the supply voltage required. **(08 Marks)**

4 a. Describe the Hopkinson's test for two identical shunt motors indicating how the efficiency of each machine on full load is obtained. **(08 Marks)**

b. A retardation test is performed on a separately excited D.C. machine as a motor. The induced voltage falls from 240 volts to 220 volts in 25 seconds, on opening the armature circuit and in 6 seconds on suddenly changing the armature connection from supply to a load resistance, which takes an average current of 10 Amperes. Find the efficiency of the machine running as a motor taking a current of 25 ampere's from 250 volts supply. Take : $R_a = 0.30\Omega$ and $R_{sh} = 200\Omega$. **(08 Marks)**

c. With a neat diagram, explain the construction of a permanent magnet D.C. motor. **(04 Marks)**

PART – B

5 a. Define the terms pitch factor and distribution factor in case of an alternator. Derive an expression for distribution factor. **(10 Marks)**

b. A 3 phase, 50 Hz, 16 pole synchronous generator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Webers, sinusoidally distributed and the speed is 375 rpm. Calculate the line induced emf. Take pitch factor as 1. **(06 Marks)**

c. Explain the advantages of having chorded coils in synchronous generator. **(04 Marks)**

6 a. Name the various methods for determining the voltage regulation for a 3 phase alternator and describe any one method in detail. **(09 Marks)**

b. A 3 phase, star connected alternator is rated at 1600 KVA, 13500 volts. The armature resistance and synchronous reactances are 1.5 Ω and 30 Ω respectively per phase. Calculate the percentage voltage regulation for a load of 1280 kW at 0.8 power factor leading. **(08 Marks)**

c. List the conditions to be fulfilled to connect two alternators in parallel. **(03 Marks)**

7 a. Derive the expression for the output power of cylindrical rotor alternator connected to infinite bus in terms of excitation voltages bus bar voltage and load angle. **(08 Marks)**

b. Explain why a synchronous motor is not self starting and describe any one method of starting. **(08 Marks)**

c. Explain the phenomenon of hunting in synchronous motors. **(04 Marks)**

8 a. With a phasor diagram, explain the concept of two-reaction theory in a salient pole synchronous machine. **(07 Marks)**

b. With a neat circuit diagram, explain the slip test on salient pole synchronous machines and indicate how X_d and X_q can be determined from the test. **(07 Marks)**

c. A 3 phase, 50 Hz, 2 pole alternator is excited to generate the bus bar voltages of 11 kV at no load. Calculate the synchronizing power per degree of mechanical displacement of the rotor. The machine is star connected and the short circuit current for this excitation is 1200 amperes. Neglect armature winding resistance. **(06 Marks)**

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