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10EE54

Fifth Semester B.E. Degree Examination, Dec.2015/Jan.2016
DC Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain with a neat sketch, the construction of DC machine. **(08 Marks)**

b. What is difference between lap and wane type of armature windings? (Any four) **(06 Marks)**

c. A short shunt compound dc generator supplies a current of 50 A at a voltage of 200 V. Calculate the generated voltage, if the resistance of the armature, shunt and series field winding are 0.04 Ω, 50 Ω and 0.02 Ω respectively. **(06 Marks)**

2 a. Derive an expression for torque developed by an armature of a DC motor. **(06 Marks)**

b. Explain any two method of speed control of a dc shunt motor. **(08 Marks)**

c. A dc series motor developing 40 NM torque is subjected to the condition that makes field flux to decrease by 30% and armature current to increase by 15%. Calculate the new torque. **(06 Marks)**

3 a. Define the efficiency of DC machine and write the condition for maximum efficiency. **(05 Marks)**

b. With a neat sketch, explain briefly the conduction to determine the efficiency of a given DC motor by Swineburn's test. **(08 Marks)**

c. A 440 V, dc shunt motor rates no load current of 2.5 A, the resistance of shunt field and series field are 550 Ω and 1.2 Ω respectively. The full load current is 32 A. Find the full load output and efficiency of motor. **(07 Marks)**

4 a. Write short notes on: i) Retardation test, ii) Field's test. **(12 Marks)**

b. A retardation test is made on a separately excited dc machine as a motor. The induced voltage falls from 240 V to 220 V in 25 seconds on opening armature circuit and in 6 seconds on suddenly charging the armature connections from supply to a load resistance which takes on average current of 10 A. Find efficiency of machine when running on a motor taking a current of 25 A on a supply of 250 V. The resistance of the armature is 0.3 Ω and that the field winding is 200 Ω. **(08 Marks)**

PART – B

5 a. Explain the detail of the constructional features of a three phase alternator. **(08 Marks)**

b. Derive the expression for pitch factor and distribution factor. **(06 Marks)**

c. A 3ϕ, 50 Hz, 10 pole alternator has 90 slots. The flux/pole is 0.15 web, if the winding is to be star connected to give a line voltage of 11000 V. Find the number of armature conductors to be connected in series/phase. **(06 Marks)**

6 a. Define voltage regulation. With a neat circuit diagram, explain briefly conduction of z.p.f. (Potier) method in laboratory to obtain regulation of alternator. **(10 Marks)**

b. A 1200 KVA, 6600 V, 3 phase star connected alternator has its armature resistance on 0.25Ω/phase and its synchronous reactance as 5 Ω/phase. Calculate its regulation if it delivers a full load (i) at 0.8 p.f. lagging, (ii) 0.8 p.f. leading. **(10 Marks)**

7 a. Write the expression synchronizing power for salient pole machine. **(05 Marks)**

b. Mention advantages of parallel operation and condition to be satisfied for successful operation of 3 phase alternators. **(08 Marks)**

c. A 10 MVA, 3 phase alternator has an equivalent short circuit reactance 20%, calculate the synchronizing power of the armature/mechanical degree/phase displacement, when running in parallel on 10000 V, 50 Hz bus bar at 1500 rpm. **(07 Marks)**

8 a. Explain briefly Blondal diagram. **(06 Marks)**

b. Explain '$\vee$' and '$\wedge$' curves on synchronous motor. **(06 Marks)**

c. A 230 V, 3ϕ star connected synchronous motor has a resistance of 0.2 Ω/phase and synchronous reactance of 2.2 Ω/phase. The motor is operating at 0.5 pf leading with a line current of 200 A. Determine the value of generated emf/phase. **(08 Marks)**

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