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10EE54

Fifth Semester B.E. Degree Examination, June/July 2017
DC Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain the process of commutation in a DC machine and explain the methods of improving commutation. **(10 Marks)**

b. The following data refers to a loaded DC generators speed = 600 rpm, Number of commutator segments = 60, brush width = 2 commutator segments, self inductance of an armature coil = 0.15 mH and current per coil = 25 A. Calculate (i) period of commutation (ii) reactance voltage for both linear and sinusoidal commutation. **(10 Marks)**

2 a. With the help of neat diagram, explain the Ward-Leonard method of speed control. **(08 Marks)**

b. Explain the various characteristic curves of DC shunt motor. **(06 Marks)**

c. A 60 kW, 500 V, DC shunt motor has a lap connected armature with 492 conductors, flux/pole is 0.05 wb and full load efficiency is 90%. Its armature resistance is 0.1Ω and shunt field resistance is 250 Ω. Find for full load (i) speed (ii) useful torque if the 6% of the torque is lost in friction. **(06 Marks)**

3 a. List the advantages and disadvantages of permanent magnet motors. **(06 Marks)**

b. What are losses in a DC machine, and derive the expression for condition for maximum efficiency. **(06 Marks)**

c. A 250 V shunt motor has an armature resistance of 0.5 Ω and a field resistance of 250 Ω. When driving at 600 rpm a load, the torque of which is constant, the armature takes 20A. If it is desired to raise the speed to 800 rpm, what resistance must be inserted in the shunt field circuit? **(08 Marks)**

4 a. Explain the Swinburn's test to determine efficiency as generator and as motor. **(10 Marks)**

b. In Hopkinson's test two shunt machines gave the following results for full load. The supply current was 15 A at 200 V. The generator output current was 85 A. The field currents for motor and generator were 2.5A and 3A respectively. The armature resistance of each machine was 0.05 Ω. Find the efficiency of each machine. **(10 Marks)**

PART – B

5 a. List the advantages of keeping armature stationary in an alternator. **(04 Marks)**

b. Derive an expression for the EMF induced in an alternator. **(08 Marks)**

c. A 3-ϕ, 16-pole, star connected alternator has 192 slots, with 8-conductors per slot and the conductors of each phase are connected in series. The coil span is 150 ele. degrees. Determine the phase and line EMF's if the machine runs at 375 rpm and the flux/pole is 6.4×10^{-2} wb, sinusoidally distributed. **(08 Marks)**

6 a. Define 'Regulation of an Alternator'. Explain the potier reactance method of finding regulation of an alternator. **(10 Marks)**

b. A 3-ϕ star connected 1000 KVA, 11000 V alternator has rated current of 52.5 A, the AC resistance of the winding per phase is 0.45 Ω. The test results are given below:

O.C. test : Field current = 12.5 A
Voltage between lines = 422 V

S.C. test : Field current = 12.5 A
Line current = 52.5 A

Determine the full load voltage regulation of the alternator at (i) 0.8 pF lag (ii) 0.8 pF lead. **(10 Marks)**

7 a. Describe the method of synchronizing a 3-phase synchronous machine, to the infinite bus bars by "Two bright one dark lamp" method, with the relevant circuit diagram. **(10 Marks)**

b. Two 20 MVA alternators operate in parallel to supply a load of 35 MVA at 0.8 pF lag. If the output of one machine is 25 MVA at 0.9 pF lag, what must be the output of the other machine and at what pF it is operating? **(10 Marks)**

8 a. Explain why synchronous motor is not self starting and discuss the methods of starting. **(10 Marks)**

b. Explain V and inverted V curves. **(06 Marks)**

c. Write a short note on hunting in synchronous motor. **(04 Marks)**

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