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NEW SCHEME

Fifth Semester B.E. Degree Examination, July 2006
Electrical and Electronics Engineering
DC Machines and Synchronous Machines

Time: 3 hrs.]

[Max. Marks:100

Note: 1. Answer any FIVE full questions.

- 1
 - a. Explain what is meant by critical field resistance in a DC shunt generator and explain a method of determining it. (05 Marks)
 - b. Explain why compensating windings are used in DC machines. (05 Marks)
 - c. Explain the process of commutation in a DC machine. (05 Marks)
 - d. A four pole, lap wound armature running at 1400 rpm delivers a current of 100 A and has 64 commutator segments. The brush width is equal to 1.4 commutator segments and inductance of each armature coil is 0.05 mH. Calculate the value of reactance voltage assuming linear commutation. (05 Marks)

- 2
 - a. Explain the characteristics of DC series motor. (06Marks)
 - b. With a neat sketch, explain the Ward-Leonard method of speed control of DC motor. (08 Marks)
 - c. A 250 V shunt motor runs at 1000 rpm while taking a current of 25 A. The resistance of the armature is 0.2 ohm and resistance of the shunt field circuit is 250 ohm. Calculate the speed when loaded to take a current of 50A. If armature reactions weaken the field by 3%, the voltage drop per brush is 1 V. Determine torques in both cases. (06 Marks)

- 3
 - a. With a neat circuit diagram, explain the importance and procedure of conducting Swinburne's test on DC motor. List the advantages of this test. Show how the efficiency as i) motor and ii) generator can be predetermined. (12 Marks)
 - b. A 240 V, 25 h.p., DC shunt motor has an armature resistance of 0.14 ohm and a field resistance of 80 ohms. If the full-load input current is 95 A, calculate i) the armature and field copper losses ii) brush contact copper loss iii) Core plus mechanical losses iv) the efficiency. Take brush drop as 1 V per brush. (08 Marks)

- 4
 - a. Explain the advantages of stationery armature over rotating armature type of construction for a synchronous machine. (06 Marks)
 - b. With usual rotations, derive the emf equation of an alternator with distributed and short pitched windings. (06 Marks)
 - c. A 3 phase 16 pole alternator has a star connected windings with 144 slots and 10 conductors per slot. The flux per pole is 0.03 wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency and line voltage. Assume full pitch coil. (08 Marks)

- 5
 - a. Describe the synchronous impedance method to determine regulation of an alternator for lagging and leading power factors. (10 Marks)

Contd....2

- b. The open and short circuit test readings for a 3 ϕ - Star connected 1000 KVA, 2000 V- 50 Hz synchronous generator are,

Field amps	10	20	25	30	40	50
OC terminal voltage	800	1500	1760	2000	2350	2600
SC armature current in a	--	200	250	300	--	--

The armature effective resistance is 0.2 ohm per phase. Draw the characteristic curves and estimate the full load percentage regulation at i) 0.8 pf lagging ii) 0.8 pf leading. (10 Marks)

- 6 a. List the conditions to be fulfilled to connect two alternators in parallel. (03 Marks)
 b. An alternator is supplying constant load. With suitable vector diagrams explain the effect of variation on excitation on armature current and power factor. (07 Marks)
 c. Two 3 ϕ synchronous generators operate in parallel on the same load. Determine the KW output and power factor of each machine under the following conditions.
 Synchronous impedance of each generator : $0.2 + j2 \Omega/\text{phase}$
 Equivalent impedance of load : $3 + j4 \Omega/\text{phase}$
 Induced emf per phase $2000 + j0$ volts for machine 1 and $2200 + j100$ for machine 2. (10 Marks)
- 7 a. With usual notations derive an expression for synchronizing power and torque when two alternators are connected in parallel. (10 Marks)
 b. Calculate the synchronizing power in KW for 1 mechanical degree of displacement at full load 0.8 power factor lagging for a 3 phase, 2000 KVA, 6600 V, 50 Hz, 12 pole synchronous machine having a synchronous reactance of 25% and negligible resistance. (10 Marks)
- 8 a. With a neat circuit diagram explain the slip test on salient pole synchronous machine and indicate how X_d and X_q can be determined from the test. (10 Marks)
 b. Write explanatory notes on the following topics
 i) Hunting in synchronous machines.
 ii) V and inverted V curves of synchronous motor. (10 Marks)
