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10EE54

Fifth Semester B.E. Degree Examination, June/July 2016
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. Derive an emf equation for DC generator with usual notations. **(05 Marks)**

b. Explain the armature reaction in DC machines with neat diagram and derive the equations for:
i) DC magnetizing ampere turns/ pole
ii) Cross magnetizing ampere turns/pole. **(08 Marks)**

c. The data for open circuit characteristics of a DC shunt generator driven at rated speed is given as :

If (A)	0.5	1	1.5	2.0	2.5	3.0	3.5
E_0(V)	60	120	138	145	149	151	152

If the resistance of field circuit is adjusted to 53 Ω. Calculate the O.C. voltage and load current when the terminal voltage is 100 V, neglect armature reaction and assume R_a = 0.1Ω. Use graph sheet. **(07 Marks)**

2 a. What is Back EMF? Explain the significance of Back EMF. **(05 Marks)**

b. Explain in brief the Ward–Leonard speed control of DC motors. **(07 Marks)**

c. A 250 V DC shunt motor has R_a = 0.08Ω. When connected to 250V DC supply it develops back emf of 242V at 1500 rpm. Determine : i) armature current ii) armature current at start iii) back emf if armature current is changed to 120 A iv) the speed of the machine if it is to be operated as a generator in order to deliver an armature current of 87A at 250V. **(08 Marks)**

3 a. What are the losses occurring in a DC machine. Explain how do they vary with load. Derive the condition for maximum efficiency of a DC generator. **(10 Marks)**

b. A long shunt compound generator delivers a F.L. current of 800A at 500V. The shunt field resistance is 100Ω. The magnetic and mechanical losses combined together are equal to 12 KW. If the full load efficiency is 92%. Calculate : i) armature resistance (R_a) and series field resistance (R_{sb}) given that $R_a = 2R_{se}$ ii) load corresponding to maximum efficiency and iii) maximum efficiency. **(10 Marks)**

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

b. Explain field's test as applied to two similar DC series motors. **(10 Marks)**

PART – B

5 a. Derive an expression for emf equation of an alternator and also mention the methods adopted to eliminate harmonics in the voltage in an alternator. **(10 Marks)**

b. A 12 pole three phase, 600 rpm, star connected alternator has 180 slots. There are 2 coil sides per slot and total 10 conductors per slot. If the flux per pole is 0.05 wb determine from first principles i) rms value of emf in a conductor ii) rms value of emf in a turn iii) rms value of emf in coil iv) per phase induced emf. Assume full pitch coil. **(10 Marks)**

6 a. Explain clearly the ZPF method of determining the regulation of an alternator [potiers triangle method) **(10 Marks)**

b. The open circuit and SC test is conducted on a 3 phase, star connected, 866V. 100 KVA alternator. The O.C test results are :

If Amp	1	2	3	4	5	6
V_{oc} line volts	173	310	485	605	728	790

The filed current of 1A, produces a S.C current of 25A. The armature resistance per phase is 0.15Ω. Calculate its full load regulation at 0.8 lagging power factor condition. **(10 Marks)**

7 a. Explain parallel operation of alternator along with necessary condition and discuss the factors on which the division of load between two alternators take place when they are working in parallel. **(10 Marks)**

b. A 230V, 3 phase, 5 KVA star connected salient pole alternator with $x_d = 12\Omega$ and $x_q = 7V$ delivers full load current at unity power factor. Calculate the excitation voltage neglecting resistance. **(10 Marks)**

8 Write short notes on :

a. Why synchronous motor is not self starting **(07 Marks)**

b. Operation of synchronous motor at constant load variable excitation **(07 Marks)**

c. Synchronous condenser. **(06 Marks)**

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