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06EE54

Sixth Semester B.E. Degree Examination, June/July 2016

DC Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assume Missing data suitably.***

PART – A

1 a. With a neat Diagram, list out the functions of all parts of a dc machine. **(08 Marks)**
b. What is meant by critical field resistance? Explain a method of determining it. **(08 Marks)**
c. Explain the process of commutation in a dc machine. **(04 Marks)**

2 a. What is armature reaction? What are the methods of eliminating it? **(08 Marks)**
b. Derive the torque equation of a dc motor. **(04 Marks)**
c. Draw and explain the characteristics of a dc compound motor. **(08 Marks)**

3 a. Explain the speed control of a dc series motor. **(04 Marks)**
b. Explain Swinburnes test predetermining the 'η' of a dc machine. **(08 Marks)**
c. A retardation test is carried out on a 1000rpm Dc machine. The time taken for the speed to fall from 1030rpm to 970rpm is :
- 36 seconds with no excitation
- 15 seconds with full excitation
- 9 seconds with full excitation and armature supporting on extra load of 10A 219V.

Calculate :
i) The moment of inertia of the armature in kg-m^2
ii) Iron loss
iii) Mechanical loss at the mean speed of 1000rpm. **(08 Marks)**

4 a. With a neat diagram, explain field test to determine the efficiency of a dc series motor and list out the merits and demerits. **(08 Marks)**
b. Write a brief note on permanent magnet motors. **(04 Marks)**
c. Two identical dc machines when tested by Hopkinson's method gave the following test results. Field currents are 2.5A and 2A, line voltage is 220V, line current including both the field currents is 10A, motor armature current is 73A. the armature resistance of each machine is 0.05Ω. Calculate the efficiency of both the machines. **(08 Marks)**

PART – B

5 a. Explain the advantages of stationary armature over rotating armature in an alternator. **(06 Marks)**
b. Derive an expression for emf induced in a distributed, short pitched stator winding of an 3ϕ alternator. **(06 Marks)**
c. A 3ϕ, 50Hz, 10pole alternator has 90 slots. The flux per pole is 0.15wb. If the winding is to be star connected to produce a line voltage of 11000 volts, find the number of armature conductors to be connected in series/phase. **(08 Marks)**

6 a. Discuss the zpf method of determination of voltage regulation of an alternator. Give the merits of this method over emf method in finding voltage regulation. **(10 Marks)**

b. The open circuit and short circuit test readings for a 3ϕ star connected 1000KVA, 2000V, 50Hz alternator are

Field amps	10	20	25	30	40	50
OC terminal voltage	800	1500	1760	2000	2350	2600
Sc armature current 'A'	-	200	250	300	-	-

The effective armature resistance is 0.2Ω/phase. Draw the characteristic curves and estimate the full load percentage regulation at i) 0.8pf lag ii) 0.8pf lead. **(10 Marks)**

7 a. Derive an expression for synchronizing power and torque when two alternators are connected in parallel. **(10 Marks)**

b. Two 3ϕ 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 Ω/phase
Equivalent load impedance : 3 + j4 Ω/phase
Induced emf per phase 2000 + j0 volts for m/c 1 and 2200 + j100 for m/c 2. **(10 Marks)**

8 a. Explain the parallel operation of two alternators with
i) Change in excitation and
ii) Change in input power **(08 Marks)**

b. Explain the phenomenon of hunting in synchronous machines. **(04 Marks)**

c. 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. **(08 Marks)**

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