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06EE54

Fifth Semester B.E. Degree Examination, Dec.09/Jan.10

D.C. Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is armature reaction in D.C. machines? Explain how armature reaction produces cross-magnetization effect and de-magnetization effect. Also derive the necessary expressions for them. **(12 Marks)**

b. A 4-Pole wave wound motor has 880 armature conductors and delivers 120 Amp current to the armature. The brushes have been displaced through three angular degrees from the geometrical axis. Calculate :

i) Demagnetising amp-turn/pole ii) Cross magnetizing amp-turn/pole

iii) Total armature reaction amp-turns **(08 Marks)**

2 a. Explain different methods of controlling speed in :

i) D.C. series motor ii) D.C. shunt motor **(10 Marks)**

b. A 230 volt DC shunt motor runs at 800 rpm and takes an armature current of 50 Amp. Find the resistance to be added to the field circuit to increase the speed to 1000 rpm at an armature current of 80 Amp. Assume Flux proportional to field current.

Armature resistance = 0.15Ω ; Field winding resistance = 250Ω **(10 Marks)**

3 a. Explain the characteristics of D.C. series and D.C. shunt motor. (Torque-current, torque-speed and speed-current characteristics). **(12 Marks)**

b. A 14.92 KW, 230 volt, 1150 rpm, 4-pole, D.C. shunt motor has a total 620 conductors arranged in two parallel paths and the armature circuit resistance is 0.2 ohm. When it delivers rated power at rated speed, it draws a line current of 74.8 Amp and a field current of 3 Amp. Calculate :

i) The flux per pole ii) The torque developed in armature iii) The rotational losses

iv) The total losses expressed as a percentage of power of input. **(08 Marks)**

4 a. What is Back E.M.F? Explain the significance of back E.M.F. **(05 Marks)**

b. What is Pitch factor? What is distribution factor? Explain and derive expression for the EMF induced in an alternator including the effect of pitch factor and distribution factor. **(10 Marks)**

c. Find the No-load phase and line voltage of a star-connected 3-phase, 6-pole alternator which runs at 1200 rpm, having flux per pole 0.1 wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot. **(05 Marks)**

PART – B

5 a. Explain, why synchronous motors are not self-starting? **(05 Marks)**

b. Write a note on, V-curve of synchronous motor. **(05 Marks)**

c. A 3-phase, 150KW, 2300 volt, 50HZ, 1000 rpm salient pole synchronous motor has X_d = 32 ohm/phase and X_q = 20 ohm/phase. Neglect the losses, calculate the torque developed by the motor if the field excitation is so adjusted as to make the back E.M.F. twice the applied voltage. Given, $\alpha = 16^\circ$. **(10 Marks)**

6 a. With a neat Phasor diagram, derive an expression for the power output of a synchronous motor. **(08 Marks)**

b. Explain the causes of Hunting in a synchronous motor. How hunting can be eliminated? **(08 Marks)**

c. What are the procedures for starting of a synchronous motor? **(04 Marks)**

7 a. What is "synchronizing" of alternators? What are the conditions for proper synchronization of alternators? How 1-Q and 3-Q alternators are synchronized? **(10 Marks)**

b. Two single phase alternators operating in parallel have induced emf on open circuit of $230\angle 0^{\circ}V$ and $230\angle 10^{\circ}V$ and the respective reactances are $j2\Omega$ and $j3\Omega$. Calculate :

i) Terminal voltage

ii) Currents

iii) Power delivered by each of the alternators to a load of impedance 6Ω (resistive) **(10 Marks)**

8 Write short notes on :

a. Hoppkinson's test

b. Permanent magnet DC motor

c. Critical field resistance of D.C shunt generator.

d. Commutation process. **(20 Marks)**

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