NEW SCHEME

EE54

Reg. No. | | | | | | | | | | |

Fifth Semester B.E. Degree Examination, January/February 2006

Electrical & Electronics Engineering

D.C. Machines & Synchronous Machines

Time: 3 hrs.) (Max.Marks : 100

Note: ***Answer any FIVE full questions.***

1. **(a)** With relevant diagrams explain armature reaction in D.C. Machines and also explain the measures adopted to reduce its effect in

   i) DC generators and

   ii) DC motors **(12 Marks)**

   (b) A 250kW, 400V, 6 pole D.C. generator has 720 lap wound conductors. It is given a brush lead of 2.5^0 (mech) from the geometric neutral. Calculate the cross and demagnetizing turns per pole. The shunt field circuit resistance is 200Ω. **(8 Marks)**

2. **(a)** Explain different methods of controlling the speed of

   i) shunt motors and

   ii) series motors, and compare their merits and demerits. **(10 Marks)**

   (b) A 250 V shunt motor has armature resistance of 0.5ohm and shunt field circuit resistance of 250Ω. When driving at 600 rpm a load, the torque q which is constant, the armature takes 20A. It desired to increase the speed from 600 to 800 rpm. What resistance must be inserted in the shunt field circuit assuming that there is no field saturation? **(10 Marks)**

3. **(a)** Mention the various methods of testing a d.c. machine and discuss on the limitations of each method. **(10 Marks)**

   (b) Following results were obtained while back to back test was performed on two shunt machines

Supply voltage	240V
Filed current of motor	2A
Field current of generator	3A
Armature current of generator	60A
Current from mains	16A
Armature resistance of each machine	0.2Ω

   Calculate the efficiency of motor and generator on full load. **(10 Marks)**

4. **(a)** Explain with reasons for the preference of revolving field system over the static field system in large alternators. **(4 Marks)**

   (b) Define : i) Breadth factor ii) Coil span factor and derive expressions for each. **(10 Marks)**

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(c) A 600 KVA, 125V alternator connected in delta is reconnected in star. Calculate its new rating in (i) Volts ii) Amperes and iii) KVA. **(6 Marks)**

5. (a) Define voltage regulation of alternator and explain the ASA method of determining it and compare this method with other known methods. **(10 Marks)**

(b) A 220V, 100KVA, star connected alternator has an effective resistance of 0.1 ohm and leakage reactance of 0.5ohm. Assume that when it is connected to a 0.4pf lagging load and delivers rated current, the armature reaction has twice the effect of armature reactance. Neglecting the effect of saturation. Calculate.

i) No load voltage when the load is suddenly thrown off with the field current and speed being the same

ii) No load voltage required to produce rated current assuming the alternator was short circuited. **(10 Marks)**

6. (a) If two synchronous machines having different impedances and different induced emfs are connected in parallel, explain with equations how they share a common load and what will be its common terminal voltage? **(8 Marks)**

(b) Two three phase 6.6kV star connected alternators supply a load of 3000kW at 0.8 p.f. lagging. The synchronous impedance per phase of these machines are respectively $(0.5 + J10)\Omega$ and $(0.4 + j12)\Omega$. The excitation of one machine is adjusted so that it delivers 150A at lagging p.f and the governors are set so that the load is shared equally between the machines. Determine:

i) the current ii) power factor
iii) induced emf's and iv) load angle of each machine

(12 Marks)

7. (a) Discuss the effect of

i) change in excitation and

ii) change in input power, when alternators are running in parallel. **(10 Marks)**

(b) A 400V, 50Hz, 6-pole, three phase, star connected synchronous motor has $X_s = 4ohm/ph$ and $R_e = 0.5ohm/ph$. On full load the excitation is adjusted so that the machine takes an armature current of 60A at 0.866 pf leading. Find the maximum power output if the total power losses are 2kW, and excitation same. **(10 Marks)**

8. (a) Obtain an expression for the power-angle equation of a salient pole alternator connected to infinite bus. Sketch this characteristic and comment on its shape. **(10 Marks)**

(b) A 1800 kVA, star connected, 6.6kV salient pole synchronous motor has $X_d = 23.2\Omega$ and $X_q = 14.5\Omega$ per phase. Its R_e is zero. Calculate the excitation emf when the motor is supplying rated load at 0.8 pf leading. If the excitation is cut off, find the maximum load that the motor can supply. **(10 Marks)**

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