[06 – 2208]

II / IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES – I

(Common with Dual Degree Programme in EEE)

(Effective from the admitted batch of 2006-2007)

Time : Three hours Maximum : 70 marks

Question no. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What are Interpoles? What should be the polarity of the interpoles with respect to the main poles in a d.c. generator?

(b) What do you understand by armature reaction in d.c. machines? What are its effects?

(c) A d.c. shunt generator is developing rated terminal voltage at some speed. If only the direction of rotation is reversed, will the generator build up? If yes, how? If not why?

6. (a) Briefly describe the methods of speed control of D.C. shunt motor.

(b) A 500 volts D.C. shunt motor takes 8 Amps on no-load. The armature and field resistances are 0.2 ohm and 250 ohms respectively. Find the efficiency of the machine when run as a motor taking a current of 90 Amperes from the supply.

7. (a) Show from the first principles, the work done per revolution of a d.c. machine is proportional to the volume of the armature.

(b) Give the layout (winding table) of a simplex lap progressive winding used for 44 slot, 4 pole, d.c. armature winding with 44 commutator segments.

8. (a) Give the steps for the design of field winding of a d.c. shunt machine.

(b) Explain the terms: continuous rating, short time rating and intermittent rating.

(c) A machine gave a temperature rise of 20°C after one hour and 32°C after 2 hours on full load. What is the steady temperature rise at full load and the heating time constant?

(d) A d.c. shunt motor is connected to a 3-point starter. Explain what would happen it the starter handle is moved rapidly from OFF position to ON position.

(e) What are the advantages of four-point starter over the three-point starter?

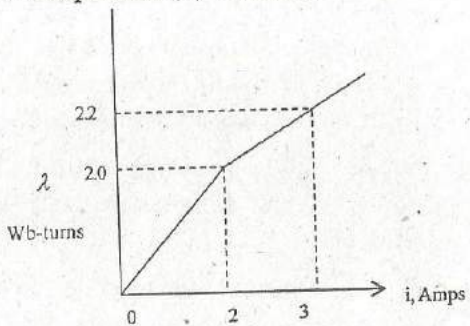
(f) 'Swinburne's test can not be performed on a d.c. series motor'. Explain the reasons.

(g) Define
(i) specific electric loading and
(ii) specific magnetic loading. Give the range of their values for a d.c. machine.

(a) Derive the expression for the torque in doubly excited magnetic systems.

(b) The $\lambda - i$ characteristics of a magnetic circuit are described by the straight line segments as shown in the figure below.

Find the energy W_{fld} and co-energy W'_{fld} for the magnetic circuit when the current is (i) 2 Amps and (ii) 3 Amps.



Figure

3. (a) Explain clearly the functions of the following:

(i) Commutator and

(ii) Compensating winding

(b) An eight pole D.C. shunt generator with 778 wave connected armature conductors and running at 500 r.p.m. supplies a load of 12.5 ohms resistance at a terminal voltage of 250 volts. The armature resistance is 0.24 ohm and the field resistance is 250 ohms. Find the armature current, the induced e.m.f. and the flux per pole.

4. (a) Mention the reasons for compounding d.c. generator. Neatly sketch and explain the external characteristic of d.c. compound generator.

(b) Two d.c. generators operate in parallel to share a total load of 116 Amps. One machine gives 410 volts on open circuit and 370 volts at a load current of 100 Amps. The other machine gives 400 volts on open circuit and 380 volts at a load of 80 Amps. The characteristics are linear between the two points for each machine. Determine how the generators share the load current and find the terminal voltage. Neglect shunt field currents of the two d.c. shunt generators.

5. (a) With a neat sketch, explain the working of a 3-point starter for D.C. shunt motor.

(b) Find the torque in NW-m exerted by a 4 pole d.c. series motor. Whose armature has 1200 conductors connected up in a 2-circuit winding. The motor current is 10 Amps and the flux per pole is 20 mWb.