[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 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) Write the conditions for maximum efficiency in DC generators.

   (b) List out methods to reduce the losses due to armature reaction.

   (c) Write the application of DC series motor.

   (d) Write different methods of excitation in DC generators.

   (e) Draw the Torque vs. speed characteristics of DC series and shunt generators.

7. (a) Write the procedural steps to calculate the losses and efficiency of DC machine using Swinburn's test.

(b) In Hopkinson's test on two identical DC shunt machines, the following readings were obtained:

Line current = 49.4A, Line voltage = 460 V, Motor armature current = 300 A, Field current = 5A and 4.4A. Armature resistance of each machine: 0.05 Ω. Calculate the efficiency of each machine.

8. (a) What is thermal constant of machine and on which factor does it depends?

(b) Calculate the diameter and length of armature for a 15 kW, 4 pole, 1000 rpm, and 220 volts shunt motor. Assume full load efficiency as 80%. Maximum air gap flux density = 0.9 Wb/m^2, specific electric loading 30,000 amp-conductor per meter, field form factor = 0.7. Assume that all losses are supplied by armature.

(f) What is DC Servo motor?

(g) Define output coefficient and its importance in design of DC machine.

2. (a) Derive the relation for the magnetic stored energy in terms of reluctance for a singly excited magnetic system.

(b) A 230 V, 50 Hz, electromagnet relay takes a current of 3A at power factor of 0.2 lagging when the armature is held in open position. When the armature is in closed position, the relay takes a current of 1A at power factor of 0.08 lagging. Find the work done in moving the armature from open to closed position.

3. (a) Derive an expansion for Induced emf in DC machines and explain significance of each term.

(b) A separately excited DC generator has armature circuit resistance of 0.1 Ω and a total drop at brushes is 2V. When running at 1000 rmp, it delivers a current of 100 A at 250V to a load of constant resistance. If the generater speed drops to 700 rpm, with field current unaltered, find the current delivered to load. Also find the additional power supplied compare to the first case?

4. (a) Draw the characteristics of DC shunt and series motor?

(b) A DC series motor is driving a fan load where the load torque is proportional to the cube of speed. The resistance of the armature and field resistance in series is 1 ohm and the motor takes 10 A and runs at 1000 rpm when operating from 200 V supply. Calculate the value of resistance to be inserted in series with armature to reduces the operating speed to 800 rpm.

5. (a) Explain the parallel operation of two shunt generator.

(b) Discuss different types of speed control mechanism for DC motor.

6. (a) With help of neat sketch, explain the operation of 4-point starter and mention its advantages.

(b) Briefly explain the principles of Metadyne.