Code: 9A02308

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B.Tech II Year I Semester (R09) Regular and Supplementary Examinations, November 2012
ELECTRICAL MACHINES - I
(Electrical & Electronics Engineering)

Time: 3 hours   Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1   With neat sketch explain the multiple-excited magnetic field system in electromechanical energy conversion systems. Also obtain the expression for field energy in the system.

2 (a)   Develop from the first principles an expression for emf of a dc generator.
  (b)   An 8-pole, lap-connected dc generator has 12 coils with 8 turns per coil. It is driven at 1500 rpm. If the flux per pole is 30 mWb, calculate the emf generated. If the machine is wave-connected, find the speed at which it is to be driven to generate the same emf as calculated with lap connection.

3 (a)   What is the purpose of Compensating Winding and explain its operation with the help of diagram.
  (b)   A 500 V, 1000 A, lap-wound, 8-pole dc generator has 1260 armature conductors. Calculate the number of conductors in the pole face to give full compensation if the pole face covers 80% of pole-span.

4 (a)   Explain the following with the help of neat diagrams:
         (i) Cumulative compounding and
         (ii) Differential compounding of dc machines.
  (b)   A 4-pole, lap-wound long-shunt dc compound generator has 1250 armature conductors. The armature, series-field and shunt-field resistances are respectively 0.6 Ω, 0.75 Ω and 225 Ω. If the shunt field flux and series field flux per pole are respectively 0.075 Wb and 0.0025 Wb, calculate the speed at which the machine has rotate to deliver a load of 120 A at 450 V. Consider the total brush drop as 2 V.

5   Two shunt generators are operating in parallel. The Generator-1 and Generator-2 are inducing emfs 120 V and 115 V, the armature resistances are 0.05 Ω and 0.04 Ω, the field resistances are 20 Ω and 25 Ω respectively. The load supplying by both generators is 35 kW. How do they share load?

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6 A 250 V, 4-pole shunt motor has two-circuit armature winding with 550 conductors. The armature circuit resistance is 0.35 Ω, field resistance is 145 Ω and the flux per pole is 0.03 Wb. Neglect the armature reaction. Find the speed and torque developed, if the motor draws 15 A from the mains.

7 Design a starter with five resistor sections for a 5 kW, 200 V, dc shunt motor. The full-load efficiency is 86 %. The lower current limit is to be full-load current. The total copper losses are 3.7 % of the input power and the field resistance is 250 Ω.

8 (a) Explain effect of excitation, speed and load on the losses of a dc machine?
   (b) A 230 V dc shunt motor is taking 5 A when running light. The armature resistance is 0.2 Ω and field circuit resistance is 115 Ω. For an input current of 72 A, calculate the shaft output and efficiency. Also calculate the armature current at which machine works at its maximum efficiency.

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