Code: 9A02308

R09

II B. Tech I Semester (R09) Supplementary Examinations, May 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   (a) What is electromechanical energy conversion?
     (b) Develop the block diagram of general electromechanical energy conversion device using energy balance equation.

2   Explain the various pitches related to armature winding of a dc machine. Derive the relation between each for lap and wave windings.

3   A 1500 kW, 550 V, 16-pole generator runs at 150 rpm. What must be the useful flux per pole if there are 2500 lap-connected conductors and full-load copper losses are 25 kW? Calculate the area of the pole-shoe if the gap flux density has a uniform value of 0.9 T and the no-load terminal voltage, neglecting armature reaction and change in speed.

4   What is the significance of critical values of field resistance and speed? Explain how they can be calculated graphically for a dc generator.

5   Two dc compound generators are operating in parallel with an equalizer-bar connection. Both machines are supplying a load of 1000 A. The machines have armature resistances of 0.06 Ω and 0.04 Ω, series-field resistances of 0.07 Ω and 0.05 Ω and induced emfs of 420 V and 440 V respectively. Calculate:
     (a) Current in each armature.   (b) Current in each series-field winding.
     (c) Current in the equalizing-bar.   (d) Bus-bar voltage.

6   A 5 kW, 250 V, dc shunt motor takes no-load armature current of 4 A at rated voltage and runs at 1200 rpm. The armature circuit resistance is 0.4 Ω and the field resistance is 250 Ω. At rated load and rated voltage, the motor takes 26 A and the armature reaction weakens the field flux by 4%. Calculate the full-load speed and the corresponding electromagnetic torque of the motor.

7   The speed of a 50 kW dc series motor working on 500 V supply is 750 rpm at full-load and at 85 % efficiency. If the load torque is made 370 N-m and a 2 Ω resistance is connected in series with the machine, calculate the speed at which the machine will run. Assume that the magnetic circuit is unsaturated and the total resistance of armature and field circuits is 0.5 Ω.

8   Two shunt machines loaded for the Hopkinson's test take 15 A at 200 V from the supply. The motor current is 100 A and the shunt currents are 3 A and 2.5 A. If the resistance of each armature is 0. 05 Ω, calculate the efficiency of each machine for its particular conditions of loading.

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