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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, May/June-2013
Electro Machines-I
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Discuss in detail the magnetic circuits and the electrical analog of magnetic circuits.
b) What is eddy-current? Explain in detail the eddy-current loss. [15]

2.a) What is the principle of operation of a DC generator? Why is a commutator and brush arrangement necessary for the operation of a DC generator?
b) A 4 pole DC armature winding having 40 slots and 120 coils is to be provided with a simplex lap winding. Work out with a suitable arrangement so that split winding is not used. [15]

3.a) Explain in detail how a DC shunt generator builds up its voltage. What limits the voltage to which it can build up?
b) A series generator delivers 100A at 250V and the resistance of the series field and armature resistance are 0.055 Ω and 0.1 Ω respectively. Calculate the armature current and generated EMF. [15]

4. A 10kW, 900 rpm, 400V dc shunt motor has armature circuit resistance (including brushes) of 1Ω and shunt field resistance of 400Ω. If efficiency at rated load is 85%, then calculate:
a) The no-load armature current
b) The speed when motor draws 20A from the mains and
c) The armature current when the total (or internal) torque developed is 98.5 N-m. Assume that flux remains constant. [15]

5. A 250 V DC shunt motor has R_f = 150 Ω and Ra = 0.6 Ω. The motor operates on no-load with a full field flux at its base speed of 1000 rpm with Ia = 5 A. If the machine drives a load requiring a torque of 100 N-m, calculate armature current and speed of motor. If the motor is required to develop 10 kW at 1200 rpm, what is the required value of the external series resistance in the field circuit? Assume linear magnetization. Neglect saturation and armature reaction. [15]

6.a) Derive an expression for the torque developed in a DC machine.
b) A 220V, DC shunt motor with an armature resistance of 0.4 Ω and a field resistance of 110 Ω drives a load, the torque of which remains constant. The motor draws from the supply, a line current of 32A when the speed is 450 rpm. If the speed is to be raised to 700 rpm, what change must be effected in the value of the shunt field circuit resistance? Assume that the magnetization characteristics of the motor is a straight line. [15]

7. With the help of neat circuit diagram, explain Hopkinson's test and derive the relations for efficiency (both for generator and motor). Also state the merits and demerits of this method. [15]

8.a) Describe the working of 3 point starter for DC shunt motor with neat diagram.

b) Explain Ward-Leonard method of speed control in DC motors. [15]

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