Code No: 53012

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, September - 2021
ELECTRICAL 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) Define field energy and co-energy. What is the significance of co-energy?
 b) Obtain an expression of torque produced by a singly excited system. [8+7]

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. [7+8]

3.a) An 8-pole generator has an output of 200A at 500V, the lap-connected armature has 1280 conductors, 160 commutators segments. If the brushes are advanced 4-segments from the no-load neutral axis, estimate the armature demagnetizing and cross magnetizing amphere-turns per pole.
 b) What is commutation? Explain how to improve it in DC generator? [8+7]

4.a) A long shunt compound generator delivers a load current of 50 A at 500 V and has armature, series field and shunt field resistance of 0.05Ω, 0.03Ω and 250Ω respectively Calculate the generated voltage and the armature current. Allow 1 V per brush for contact drop.
 b) Distinguish between self excited and separately excited d.c generators. How is self excited d.c generators classified? Give their connection diagram? [8+7]

5.a) Draw the connection diagrams for the shunt, series and compound generators and discuss their load characteristics.
 b) A long shunt compound generator has a shunt field winding of 1000 turns per pole and series field winding of 4 turns per pole and resistance 0.05 ohms. In order to obtain the rated voltage both at no-load and full load for operation as shunt generator, it is necessary to increase field current by 0.2 A. The full load armature current of the compound generator is 80 A. Calculate the diverter resistance connected in parallel with series field to obtain flat compound operation. [7+8]

6.a) Derive an expression for the electromagnetic torque produced by d.c motor.
 b) Derive the torque- current characteristics of d.c shunt, series and cumulative compound motors. Also, draw these characteristics in one figure on the assumption of (i) same torque at no-load and (ii) rated torque at rated current. [7+8]

7.a) Explain the flux control and armature control methods of speed control of DC Shunt motors.

  b) A 220 V d.c. shunt motor has an armature resistance of 0.5 Ohm and takes an armature current of 40 A on a certain load. By how much must the main flux be reduced to raised speed by 50% if the developed speed is constant? Neglect saturation and armature reaction. [10+5]

8.a) State the expressions for eddy current and hysteresis losses in a d. c. machine.

  b) The no load test of a 45kW, 230V d.c. shunt motor gave the following results: input current = 14A; field current = 2.55A; Resistance of armature at $^0C5$ = 0.032Ω; Brush drop = 2V; Estimate the full load current and efficiency. [7+8]

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