3E1645

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B.Tech. (Sem.III) (Main/Back) Examination, 2015
Electrical Engineering
3EE5 Electrical Machines-I

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 26

Instructions to Candidates :
Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams m be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calcula must be stated clearly.

UNIT - I

1. (a) Explain the phenomenon of energy balance. Derive an expression for energy stored in magnetic circuit.
   (b) Discuss permanent magnets and their applications.

OR

1. (a) With help of a suitable diagram explain hysteresis and eddy-current losses as applied to magnetic material.
   (b) The flux in a magnetic core is alternating sinusoidally at a frequency of 600Hz. The maximum flux density is 2T and the ed current loss is 15W. Find the eddy-current loss in the core if frequency is raised to 800Hz and the maximum flux densit reduced to 1.5T.

UNIT - II

2. (a) Obtain EMF equation for a DC machine.
   (b) Explain armature reaction process.

OR

2. (a) Explain the meaning and significance of the critical field resistance of a shunt generator.
   (b) State the condition which determines if a DC machine is in generating or motoring mode.
   (c) Draw the power flow diagram of a DC generator. Also discuss the condition for maximum efficiency.

UNIT - III

3. (a) Sketch the speed-torque characteristics method of speed control of a DC series motor.
   (b) Enumerate and classify the losses in a DC shunt motor.

OR

3. (a) Explain different methods of braking of DC motors.
   (b) A DC shunt motor has speed control range of 1600 rpm to 400 rpm by rheostatic control. All losses and armature rea effect may be neglected.
      (i) The motor drives a constant power load. It has a speed of 1600 rpm drawing 120 A armature current. What would b armature current at 400 rpm?
      (ii) Repeat part
      (iii) If load is constant torque.
   (c) Repeat parts (a) and (b) if speed is controlled by armature voltage.

UNIT - IV

4. (a) Justify that under SC test the core losses are negligible.
   (b) Discuss back-to-back (Sumpner's test) test on single- phase transformers. (4)
   (c) A transformer has its maximum efficiency of 0.98 at 15 kVA at upf. Compare its all day efficiencies for the following load cycles: (8)
   (i) Full load of 20 kVA 12 hours/day and no-load rest of the day.
   (ii) Full load 4 hours/day and 0.4 full load rest of the day.
   Assume the load to operate on upf all day.

OR

4. (a) Draw and explain the idea of a welding transformer. (8)
   (b) A 500 kVA transformer has an efficiency of 98% at full load and also at 65% full load: both at 0.7 Pf lagging.
   (i) Separate out the losses of transformer
   (ii) Determine the efficiency of transformer at $3/4^{th}$ full load. (8)

UNIT - V

5. (a) Discuss following with respect to three - phase transformers: (8)
   (i) Open delta connection (ii) Scott connection
   (b) Explain parallel operations of three - phase transformers. Also list the conditions to be net for successful parallel operation. (8)

OR

5. Write notes on any two of the following : (8 + 8 = 16)
   (a) Excitation phenomenon of transformers
   (b) Switching currents in transformers
   (c) Magnetizing inrush current in transformers.

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