3E1645

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 must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated 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 eddy current loss is 15W. Find the eddy-current loss in the core if frequency is raised to 800Hz and the maximum flux density 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 reaction 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 be 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 3/4th 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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