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Question Paper Code : 51447

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Sixth Semester

Electrical and Electronics Engineering

EE 2355/EE 65/10133 EE 605 — DESIGN OF ELECTRICAL MACHINES

(Regulation 2008/2010)

(Common to PTEE 2355 — Design of Electrical Machines for B.E. (Part-time) Fifth Semester — Electrical and Electronics Engineering — Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define Specific Electric Loading.

2. Write down the classification of magnetic materials.

3. What are the factors to be considered in the design of commutator of a DC machine?

4. Write any two guiding factors for the choice of number of poles.

5. Define the term: 'Voltage Regulation'.

6. What are the methods by which heat dissipation occurs in a transformer?

7. Write down the output equation of 3-phase induction motor.

8. Define: Stator Slot Pitch.

9. Define specific magnetic loading of a synchronous machine.

10. Define Short Circuit Ratio of a synchronous machine.

PART B — (5 × 16 = 80 marks)

11. (a) What are the main groups of Electrical conducting materials? Describe the properties and applications of those materials. (16)

Or

(b) Explain in detail the various cooling methods of electrical machines. (16)

12. (a) Explain the various steps involved in the design of Armature winding of D.C. machine. (16)

Or

(b) A design is required for a 50 kW, 4 pole, 600 rpm, d.c. shunt generator, the full load terminal voltage being 220 V. If the maximum gap density is 0.83 Wb/m^2 and the armature ampere conductors per metre are 30,000, calculate suitable dimensions of armature core to give a square pole face. Assume that the full load armature voltage drop is 3 percent of the rated terminal voltage and that the field current is 1 percent of rated full load current. Ratio of pole arc to pole pitch is 0.67. (16)

13. (a) Develop the output equation for a single phase as well as a three-phase transformer. (16)

Or

(b) A 6600 V, 60 Hz single phase transformer has a core of sheet steel. The net iron cross-sectional area is 22.6×10^{-3} m^2, the mean length is 2.23 m, and there are four lap joints. Each lap joints takes ¼ times as much reactive mmf as is required per metre of core. If B_m=1.1 Wb/m^2, Determine.

(i) The number of turns on the 6600 V winding and

(ii) The no load current.

Assume an amplitude factor of 1.52 and that for given flux density, mmf per metre = 232 A/m; specific loss = 1.76 W/kg. Specific gravity of plates = 7.5. (16)

14. (a) Describe the steps involved in the design of end rings. (16)

Or

(b) Estimate the stator core dimensions and the total number of stator conductors for a 3Φ, 100 kW, 3300 V, 50 Hz, 12 pole star connected slip ring induction motor. Assume : average gap density = 0.4 Wb/m^2, conductors per metre = 25,000 A/m, efficiency = 0.9, power factor = 0.9 and winding factor = 0.96. Choose main dimension to give best power factor. (16)

15. (a) Explain the step by step procedure for the design of field winding of Synchronous machine. (16)

Or

(b) Determine a suitable number of slots and conductors per slot, for the stator winding of a 3 phase 3300V, 50Hz, 300 rpm alternator. The diameter is 2.3m and the axial length of core is 0.35 m. The maximum flux density in the air gap should be approximately 0.9 Wb/m^2. Assume sinusoidal flux distribution. Use single layer winding and star connection for stator. (16)