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Question Paper Code : 21407

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Sixth Semester

Electrical and Electronics Engineering

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

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define specific Electric Loading.

2. What are the major considerations in Electrical Machine Design?

3. Write down the output equation of a d.c. machine.

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

5. What are the cooling methods used for dry type transformers?

6. Define Window Space Factor.

7. Write down the equation for output coefficient in an Induction Motor.

8. What is meant by an Ideal short circuit current?

9. What are the factors that influence the choice of specific magnetic loading in a synchronous machine?

10. Define Short Circuit Ratio of a synchronous machine.

PART B — ($5 \times 16 = 80$ marks)

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

Or

(b) Describe the methods of measurement of temperature rise in various parts of an electrical machine. (16)

12. (a) Explain the various steps involved in the design of commutator and Brushes of a d.c. machine. (16)

Or

(b) Calculate the diameter and length of armature for a 7.5 kW, 4 pole, 1000 rpm, 220 V shunt motor. Given: full load efficiency = 0.83; maximum gap flux density = 0.9 Wb/m^2; specific electric loading = 30,000 ampere conductors per metre; field form factor = 0.7. Assume that the maximum efficiency occurs at full load and the field current is 2.5 percent of rated current. The pole face is square. (16)

13. (a) Describe the methods of cooling of transformers. (16)

Or

(b) A single phase, 400 V, 50 Hz, transformer is built from stampings having a relative permeability of 1000. The length of the flux path is 2.5 m, the area of cross-section of the core is 2.5×10^{-3} m^2 and the primary winding has 800 turns. Estimate the maximum flux and no load current of the transformer. The iron loss at the working flux density is 2.6 W/kg. Iron weighs 7.8×10^3 kg/m^3. Stacking factor is 0.9. (16)

14. (a) Describe the effect of dispersion co-efficient due to the following factors in an induction motor :

(i) Overload capacity, (4)

(ii) Air gap length, (4)

(iii) Number of poles and (4)

(iv) Frequency. (4)

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 2.3 m 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)
