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Question Paper Code : 21513

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Sixth Semester

Electrical and Electronics Engineering

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

(Regulations 2008/2010)

(Common to PTEE 2355/10133 EE 605 – Design of Electrical Machines for B.E. (Part-Time) Fifth Semester – Electrical and Electronics Engineering – Regulations 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the major considerations in electrical machine design?

2. Define space factor.

3. Distinguish between real and apparent flux density.

4. Write down the Carter's coefficient of d.c. machine.

5. Why is transformer yoke designed for low flux density?

6. What are the methods of cooling of transformers?

7. What are the advantages of larger air gap length in an induction motor?

8. Write down the rules for selecting rotor slots of squirrel cage induction motor.

9. Define short circuit ratio of a synchronous machine.

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

PART B — (5 × 16 = 80 marks)

11. (a) Discuss about the factors that influence the choice of specific electric and magnetic loadings in the design of rotating machines. (16)

Or

(b) Describe any two methods used for determination of motor rating for variable load drives. (16)

12. (a) (i) Derive the output equation of a DC machine. (8)

(ii) Explain the different methods adopted to reduce the effects of armature reaction. (8)

Or

(b) Calculate the mmf required for the air gap of a machine having core length = 0.32 m including 4 ducts of 10 mm each, pole arc = 0.19 m, slot pitch = 65.4 mm, slot opening = 5 mm, air gap length = 5 mm, flux per pole = 52 mWb. Given: Carter's coefficient is 0.18 for opening/gap = 1, and is 0.28 for opening/gap = 2. (16)

13. (a) Explain the different 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 7.8×103 kg/m^3. Stacking factor is 0.9. (16)

14. (a) State and explain the factors to be considered when estimating the length of air-gap of a 3-phase induction motor. (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) Illustrate the steps required for the design of damper winding of synchronous machine and show the position of damper bars in a diagram. (16)

Or

(b) Determine a suitable number of slots and conductors per slot, for the stator winding of a 3 phase 3300V, 50 Hz, 300rpm 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)
