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Reg. No. : .....

Name : .....

Eighth Semester B.Tech. Degree Examination, April 2014
(2008 Scheme)
08.802 : ELECTRICAL MACHINE DESIGN (E)

Time : 3 Hours Max. Marks : 100

***Instruction**: Answer **all** questions from Part **A** and **one** full question from **each** Module of Part **B**.*

PART – A

1. Explain the factors to be considered while designing electrical machines.
2. Distinguish between distribution and power transformers.
3. What are the different types of ratings for an electrical machine ?
4. Describe the classification of insulating materials based on temperature.
5. Derive the output equation of a DC machine.
6. Describe any two methods for the calculation of mmf for tapered tooth.
7. Determine the length of air gap in a dc machine if the air gap mmf/pole = 3675 A, average flux density in the gap = 0.6 wb/m^2 and the ratio of pole arc to pole pitch = 0.7.
8. Derive an expression for end ring current in induction motor.
9. Explain the rules for selecting rotor slots for squirrel cage induction motor.
10. Compare analysis and synthesis method of CAD of electrical machines.

(10×4= 40 Marks)

PART – B

Module – I

11. a) Derive an expression for the number of cooling tubes needed for a transformer tank. 10

    b) An induction motor has a final temperature rise of 40°C when running at its rated output. Calculate its half hour rating for the same temperature rise, if copper losses at rated output is equal to 1.25 times constant losses. Heating time constant = 90 minutes. 10

12. a) Derive the heating equation of a homogenous body and hence obtain the temperature rise time curve. 10

    b) Determine the dimensions of core and yoke for a 200 kVA, 50 Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 14 V, $B_m = 1.1$ Wb/m^2, $K_w = 0.32$, $\delta = 3$A/mm^2 and stacking factor = 0.9. 10

Module – II

13. a) Distinguish between real and apparent flux density in the teeth of a slotted armature and derive an expression connecting them. 10

    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. 10

14. a) Explain the factors to be considered for the selection of specific magnetic loading of a dc machine. 5

    b) Determine the main dimensions, no. of poles and length of air gap of a 600 kW, 500 V, 900 rpm generator. Assume average gap density = 0.6 Wb/m^2 and ac = 35000. The ratio of pole arc to pole pitch is 0.75 and efficiency is 91%. The following are the design constraints :

    peripheral speed $\leq$ 40 m/s, frequency of flux reversal $\leq$ 50 Hz, current/ brush $\leq$ 400 A and armature mmf $\leq$ 7500 A. The mmf required for air gap is 50% of armature mmf and gap contraction factor is 1.15. 15

Module – III

15. a) Derive the output equation of a 3ϕ induction motor. 8

    b) Determine the main dimensions of 10 kW, 400 V, 50 Hz, 4 pole, 3 phase induction motor. $B_{avg} = 0.45$ Wb/m^2, ac/cm = 220, $\eta = 0.9$, pf = 0.85. Determine no. of conductors per phase when the stator is star connected. 12

16. a) Find the main dimensions of a 2500 kVA, 187.5 rpm, 50 Hz, 3 phase, 3 kV, salient pole synchronous generator. The generator is to be a vertical, water wheel type.. The specific magnetic loading is 0.6 wb/m^2 and specific electric loading is 34000 A/m. Use circular poles with ratio of core length to pole pitch = 0.65. 10

    b) Explain the general procedure for optimisation in the design of an electrical machine. 6

    c) Mention the advantages of CAD. 4