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Reg. No. : .....

Name : .....

Eighth Semester B.Tech. Degree Examination, April 2015
(2008 Scheme)
08.802 : Electrical Machine Design (E)

Time : 3 Hours Max. Marks : 100

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

PART – A

1. Discuss the advantages of hydrogen as a cooling medium as compared to air.
2. The temperature rise of a loaded transformer is 15°C after one hour and 23°C after two hours of loading. Determine the steady temperature rise and heating time constant.
3. Show that the voltage per turn, $E_t = K\sqrt{Q}$ where K is a constant and Q is the kVA rating of the transformer.
4. List the Indian standard specifications for transformers and induction motors.
5. What are the factors to be considered for the choice of number of armature slots in a DC machine.
6. Explain field form factor. Find the average gap density in a dc machine if maximum gap density = 0.8 Wb/m^2 and field form factor = 0.75.
7. What are the advantages of having large number of poles in DC machines ?
8. What are the factors to be considered for estimating the length of air gap in induction motors ?
9. Explain the factors to be considered for the separation of D and L for salient pole machines.
10. What is Short Circuit Ratio (SCR) ? How SCR affects the design of alternators ?

(10×4=40 Marks)

P.T.O.

PART – B

Module – I

11. a) Derive the output equation of a 3ϕ transformer. 10

b) A 400 kVA transformer has its maximum efficiency at 80% full load. The temperature rise after 1hr. and 2 hrs. at full load are 24°C and 32°C respectively. Find T_h and θ_m. The cooling is improved so that the rate of heat dissipation is increased by 15%, find the new kVA rating for the same final temperature rise as before. 10

12. a) Estimate the no. of cooling tubes required for the tank of a 400 kVA, 1ϕ oil immersed natural cooled transformer. Tank is 150 cm in height, 100 cm long, 60 cm width. Diameter of tube = 5 cm, length of tube = 127.5 cm, spacing should not be less than 7.5 cm between the centres. Full load loss to be dissipated is 6.34 kW. Mean temperature rise of tank wall is 35°C. Sketch the plan showing the arrangement. 14

b) Explain the different types of ventilation system used in electrical machines. 6

Module – II

13. a) Explain the different methods employed for the calculation of mmf required for tapered tooth. 8

b) Estimate the ampere turns/pole required for the air gap of a 500V, 6 pole, 300 rpm, lap connected dc machine. The armature core length is 30 cm, having 90 slots. The pole pitch is 50 cm while pole arc is 33 cm. The air gap length = 0.5 cm, conductors/slot = 16, width of slot = 1.3 cm. Ventillating ducts = 5, width of slot = 1.3 cm. Ventillating ducts = 5, width of each duct = 1 cm. Carter's coefficient is 0.66 and 0.72 for width/gap of 2.6 and 2 respectively. 12

14. a) Calculate the number of poles and main dimensions for a d.c. generator to develop 1800 kW, 600V running at 300 rpm. Assume specific loadings of 0.7 Wb/m^2 and 40,000 A/m. 10

b) Explain the factors which affect the choice of specific electric and magnetic loadings of a d.c. machine. 10

Module – III

15. Determine the diameter and length of stator core for a 70HP, 415V, 3 phase, 50 Hz, star connected 6 pole induction motor for which Bav = 0.51Wb/m^2, a.c. = 32000 A/m, efficiency = 0.9 and power factor = 0.91. Assume pole pitch = core length. Estimate the number of stator conductors in which conductors are connected in two parallel paths. Choose a suitable number of conductors/slot so that slot loading does not exceed 750 Ampere conductors. Find the size of the conductors if the current density is 4A/mm^2. 20

16. a) Determine a suitable number of slots and conductors per slot for the stator winding of a 3 phase, 3.3 kV, 50 Hz, 300 rpm alternator. The diameter is 230 cms and the axial length of core is 35 cms. The maximum flux density in air gap is nearly 0.9 Wb/m^2. Assume sinusoidal flux distribution. Use single layer winding star connection for stator. 14

b) Explain the procedure of optimization in the design of three phase induction motor. 6