ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : DECEMBER 2009

REGULATIONS : 2007

FIFTH SEMESTER : ELECTRICAL AND ELECTRONICS ENGG.

070280032 - ELECTRICAL MACHINE DESIGN

TIME : 3 Hours **Max.Marks : 100**

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. What are the constituents of magnetic circuit in rotating machines?
2. What is magnetization curve?
3. What is gap contraction factor for slots?
4. Give the Simpson's rule for calculation of mmf for tooth.
5. Write the factors governing the length of armature core in dc machines.
6. Define copper space factor for a coil.
7. State the relationship between number of armature coils and number of commutator segments in a dc machine.
8. State the merits of lap and wave winding of armature of dc machine.
9. Name a few insulating materials that are used in transformers.
10. Why the efficiency of a transformer is so high.
11. List various advantages and disadvantages of using higher flux density in design of core.
12. Mention the main function of cooling medium used in transformers.
13. Why do 3 phase squirrel cage induction motor finds wide application in industry.
14. Why the length of air gap in induction motor is kept minimum possible.
15. Write down the main consideration in the selection of specific loadings for the design of induction motor.

16. Why semi- closed slots are generally preferred for the stator of induction motors.
17. What is critical speed of alternator?
18. What are the functions of damper winding.
19. Why salient pole construction is rejected for high speed alternators.
20. Write the expression for the output coefficient of synchrouns machine.

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. Determine the air gap length of a dc machine from the following particulars: gross length of core=0.12m, No.of ducts=1 and is 10mm wide, slot pitch=25mm, slot width=10mm, carter's co – efficient for slots and ducts = 0.32, gap density at pole centre =0.7 wb/m^2 ;field mmf/pole=3900 AT,mmf required for iron parts of magnetic circuit=800AT

22. a. A laminated steel tooth of armature for a dc machine is 30mm long and has a taper such that the maximum width is 1.4 times the minimum. Estimate the mmf required for a mean flux density of 1.9 wb/m^2 in the tooth.B-H characteristics of steel is given below — 8

B wb/m^2	1.6	1.8	1.9	2.0	2.1	2.2	2.3
H A/m	3700	10000	17000	27000	41000	70000	109000

b. What is meant by rating of machine? 4

23. State and explain the factors which govern the choice of specific magnetic loading in a dc machine.(Nov 2007)

24. Design a suitable commutator for a 350 KW, 600 rpm, 440 V, 6 pole dc generator having an armature diameter of 0.75 m. The number of coils is 288. Assume suitable values wherever necessary.

25. Estimate the main dimensions including winding conductor area of a 3=phase, Δ-y core type transformer rated at 300 KVA, 6600/440 V, 50 Hz. A suitable core with 3-steps having a circumscribing circle of 0.25 m diameter and a leg spacing of 0.4 m is available. Emf/turn = 8.5V, δ=2.5 A/mm^2 K_w=0.28, S_f=0.9 (stacking factor).

26. Estimate the main dimensions, air-gap length, stator slots, stator turns per phase and cross sectional area of stator and rotor conductors for a 3-phase, 15 HP, 400 V, 6 pole, 50 Hz, 975 rpm, induction motor. The motor is suitable for star delta starting. B_{av} = 0.45 Wb/m^2, ac = 20000 amp.cond/m, L\τ = 0.85, η = 0.9, pf = 0.85

27. a. Estimate the stator core dimensions, number of stator slots and number of stator conductors per slot for a 100 KW, 3300 V, 50 Hz, 12 pole, star connected slip ring induction motor. B_{av}= 0.4 Wb/m^2, ac = 25000 amp.cond/m, η = 0.9, pf = 0.9. Choose main dimensions to give best power factor. The slot loading should not exceed 500 amp. Conductors. 8

b. Explain the design of rotor bars. 4

28. a. Derive output equation of a synchronous machine. 6

b. With neat sketch indicate the location of a damper windings in a synchronous machine and mention its uses. 6

*****THE END*****