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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

ELECTRICAL AND ELECTRONICS ENGG.

Semester : 6

EE9355 DESIGN OF ELECTRICAL APPARATUS

(Regulation 2008)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. How the value of specific magnetic loading does effects the size of the machine?
2. Define: Carter's Co-efficient for slots and ducts? What is its usefulness in the design of dc machine?
3. Write the importance of output coefficient in fixing the main dimensions of a DC machine
4. Calculate the front pitch and back pitch for a lap wound armature having 24slots, 4 poles and 2 conductors per slot.
5. Stepped core section is preferred to a square section for transformers, Give reasons.
6. Why is more difficult to cool a transformer than a rotating machine of the same capacity?
7. What value of specific electric and magnetic loading will you assume for designing a 25 h.p., 400 v Induction motor?
8. What is normally the speed range of water wheel generators and turbo generators?
9. Why radial ventilating ducts are provided along the length of the stator core?
10. Write the merits of using digital computers in designing electrical machines

Part – B (5 x 16 = 80 marks)

11. i Distinguish between continuous rating and short time rating of an electrical machine.

    ii A 6-pole D.C. machine has the following design data. Armature diameter=30cm, armature core length=15cm,length of air gap at pole center =0.25cm,flux per pole=12milliweb. Field form factor=0.65. Calculate the amp. turns required for the air gap
    - if the armature surface is smooth
    - if the armature surface is slotted and the gap expansion factor is 1.2

12. a) i What are the main parts of a DC generator? (4marks)

    ii Determine the diameter and length of armature core for a 55 KW, 110V, 1000 rpm, 4 pole shunt generator, assuming specific electric and magnetic loadings of 26000 amp.cond./m and 05 Wb/m^2 respectively. The pole arc should be about 70% of pole pitch and length of core about 1.1 times the pole arc. Allow 10 ampere for the field current and assume a voltage drop of 4 volts for the armature circuit. Specify the winding used and also determine suitable values of the number of armature conductors and number of slots. (12 marks)

(OR)

b) i Calculate the size of the conductor and number of turns for the field coil of a 6 poles, 460 V dc shunt motor. The coil is to supply 4000 AT at the working temperature, where $\rho = 0.02$ micro - ohm - m. The length of the inside turn is 0.74 m, the space factor of the winding is 0.52 and the permissible dissipation per sq.m. of external surface (excluding the two ends) is 1200 watts. Solution should not be attempted by assuming a numerical value for the winding depth.

13. a) i Mention the various types of cooling methods for large power transformers. Classify transformers according to its cooling methods.

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

(OR)

b) i A 3 phase core type transformer having 26 kW Iron loss and 99 kW copper losses in immersed in oil. The length, width and height of the oil tank are 2.7 m, 1.1 m, 3.5 m respectively. Assuming specific heat dissipation due to radiation and convection respectively 6 and 6.5 $w/.m^2/C$. Calculate temperature raise of the transformer without cooling tubes. Also estimate the no of cooling tube required to keep the temperature raise at 50 C using standard tubes of 50mm in diameter and 3.3 m long. Show the cooling tubes arrangement.

14. a) i What are the factors to be considered for estimating the length of air-gap in induction motor?

ii Design a cage rotor for a 40hp , 3 phase , 400 v, 50 Hz , 6 pole , delta connected induction motor having full load efficiency of 87% and a full load power factor of 0.85. Take D=33cm and L=17cm. Stator slots =54. Conductors per slots=14. Assume the necessary data.

(OR)

b) i Determine for a 500KVA, 6600 V, 12-pole, 500 rpm,star connected 3-phase salient pole alternator, suitable values for the diameter at the airgap, core length, the number of stator conductors and the number of stator slots. Specific magnetic loading and specific electric loading may be taken as 0.6T and 3000 ampere conductors per metre of periphery.

15. a) i Bring out the main difference in the design procedure of a three-phase cage induction motor with three-phase slip ring induction motor.

ii Define: SCR. Discuss the effect of SCR on the performance of a synchronous machine.

(OR)

b) i What is Role of finite element analysis in computer aided design? What are the advantages and disadvantages of Finite element method for electrical machine design.

ii Write the features of computer aided design of electrical machines. Briefly explain about the "Analysis method" and list the advantages