26/10/13

B.E. (FULL-TIME) DEGREE END SEM EXAMINATIONS NOV/DEC 2013
ELECTRICAL AND ELCTRONICS ENGINEERING
VI SEMESTER (REGULATION 2002/2004/2008)
EE336/EE384/EE9355 DESIGN OF ELECTRICAL APPARATUS

Time: 3 Hours Max. Marks: 100

Answer ALL Questions

PART – A (10 x 2 = 20 Marks)

1 What are the materials used for slip-rings and brushes in induction motor?
2 How is heat produced in a rotating electrical machine?
3 State the difference between armature winding of dc machine and stator winding of ac machine.
4 State the relationship between number of armature coils and number ofcommutator segments in d.c. machine
5 Why the area of yoke of a transformer is usually kept 15 to 20 % more than that of core?
6 In transformer, why the low voltage winding is placed near the core.
7 Write the expression for output equation and output coefficient of induction motor.
8 What are the factors to .be considered for estimating the length of air-gap in induction motor?
9 What is the limiting factor for the diameter of synchronous machine?
10 How is computer aided design different from conventional design in the case of electrical apparatus?

PART – B (5 x 16 = 80 Marks)

11 (i) Write the features of computer aided design of electrical machines. Explain about the "Analysis method" and list the advantages (8)

(ii) Explain the step by step procedure for finding the magnetic flux density for any electrical apparatus using FEM. (8)

12 a (i) Write a short note on standard specifications. List the Indian Standard Specifications for transformer. (8)

(ii) What is the fundamental requirement of a good insulating material? What is the importance of temperature as a factor in the life of insulating materials? Classify the insulating material. (8)

OR

b (i) List the methods used for estimating the mmf for teeth. Explain any one method in detail. (8)

(ii) Calculate the mmf for air-gap in a three phase induction motor from the following data. Stator bore=500mm, core length =220mm, stator slots=76 , rotor slots=94 , slot opening=2mm , air-gap=0.9mm. Take $K_{gd}$=1.1.5 and air-gap flux density=0.54 tesla. (8)

13 a (i) Derive the out put equation of a DC machine. (6)

(ii) Find the main dimensions and the number of poles of a 37 KW, 230V, 1400 rpm shunt motor so that a square pole face is obtained. The average gap density is 0.5 Wb/$m^2$ and the ampere conductors per metre are 22000. The ratio of pole arc to pole pitch is 0.7 and the full load efficiency is 90 percent. (10)

OR

b (i) List the advantages and disadvantages of large number of poles. Mention the guiding factors for selection of number of poles. (6)

(ii) Determine the total commutator losses for a 1000 KW, 500V, 800 rpm, 10 pole generator. Given that commutator diameter = 1.0 m, current density at brush contact = 75 x $10^{-3}$ A.mm$^2$, brush pressure = 14.7 KN/m$^2$, coefficient of friction = 0.28, brush contact drop = 2.2 V. (10)

14 a (i) What are the advantages and disadvantages of stepped cores? Draw the cruciform section of the transformer core and give the optimum dimensions in terms of circumscribing circle diameter d. (6)

(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, $\delta$ = 2.5A/mm$^2$, $K_w$ = 0.28, $S_f$ = 0.9 (10)

OR

b (i) Discuss about the various methods of cooling of power transformer. (6)

(ii) The tank of a 500 kVA, 50Hz, 1-phase, core type transformer is 1.05 x 0.62 x 1.6 m high. The mean temperature rise is limited to 35°C. The loss dissipating surface of tank is 5.34 m2. Total loss is 5325 W. Find the area of tubes and number of tubes needed. (10)

15 a (i) List the undesirable effects produced by certain combination of rotor and stator slots. (6)

(ii) 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\$\tau$ = 0.85, $\eta$ = 0.9, pf = 0.85 (10)

OR

b (i) Draw a neat sketch of a rotor of a turbo-alternator showing ventilating ducts, conductor and insulation arrangements damper bar and wedge. Also draw a stator slot showing conductor and insulation arrangements (6)

(ii) Determine the output coo-efficient for a 1500KVA 2200 volt 3 phase 10 pole 50 Hz star connected alternator with sinusoidal flux distribution. The winding has 60$^0$ phase spread and full pitch coils. ac=30000 amp.cond./m, $B_{av}$ = 0.6Wb/m$^2$ .If the peripheral speed of rotor must not exceed 100m/sec and the ratio pole pitch to core length is to be between 0.6 and 1, find D and L. Assume an air gap length of 6mm. Find also the approximate number of stator conductors. (10)