**B.E (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2013**

Electrical and Electronics Engineering

VI SEMESTER (REGULATION 2008)

**EE 9355: DESIGN OF ELECTRICAL APPARATUS**

Time: 3 Hours Max. Marks: 100

Answer ALL Questions

**PART – A (10 x 2 = 20 Marks)**

1 How fixed losses are accounted in small DC machines?
2 How magnetization curve is made use of in the design of electrical machines?
3 How do design the number of brushes for a dc machine?
4 Define: Length of mean of field coil
5 What factor decides the number of turns in a transformer winding?
6 Estimate the relation between voltage per turn and the rating of a transformer.
7 State the choice of ratio of pole arc to pole pitch in induction motor design
8 What are ranges of efficiency and power factor in induction motor?
9 With a sketch indicate the location of damper windings in a synchronous machine.
10 What is Role of finite element analysis in computer aided design?

**PART – B (5 x 16 = 80 Marks)**

11 a (i) Discuss the electrical properties of insulating materials? List the names of insulating materials used in modern electrical machines? (8)

(ii) Calculate the mmf of 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 length= 0.9mm, Take $K_{gt}$=1.15 and air-gap flux density =0.54 wb/$m^2$. (8)

12 a (i) Discuss the factors which govern the choice of number of poles in a dc machine. (6)

(ii) Design the main dimensions of a separately excited industrial motor 240V , 4 pole , 75kw continuous rating , duty cycle S1, 1000 rpm, screen protected , class B insulation. Make the necessary assumptions. Find the pole arc, pole pitch. (10)

**OR**

b (i) Discuss the choice of poles and speed in DC machine. (6)

(ii) Determine the total commutator losses for a 1000kW, 500V, 8000rpm, 10 pole generator. commutator diameter=1.0m, current density at brush contact = $75*10^{-3}$ A/$mm^2$, brush pressure = 14.7kN/$m^2$ coefficient of friction = 0.28, brush contact drop = 2.2V. (10)

13 a (i) Explain how to estimate no-load current of a three phase transformer. (6)

(ii) Design a 3 phase 250kVA 6600/400v 50Hz core type distribution transformer by properly assuming the values of various design parameters. Assume cruciform section for the core. Tabulate the result. Tabulate the assumed values. (10)

**OR**

b (i) Derive the output equation of a 3-phase transformer. (6)

(ii) The tank of 1250kVA, natural oil cooled transformer has the dimensions length, width and height as 0.65*1.55*1.85 m respectively. The full load loss = 13.1kW, loss dissipations due to radiations = 6 W/$m^2$ degree centigrade, loss dissipations due to radiations = 6.5 W/$m^2$ degree centigrade, improvement in convection due to provision of tubes = 40%, temperature rise = 40 degree Centigrade, length of each tube = 1m, diameter of tube = 50mm. Find the number of tubes for this transformer. Neglect the top and bottom surface of the tank as regards the cooling. (10)

14 a (i) Discuss points to be considered for estimating the length of air gap of an induction motor. (6)

(ii) A 90 kW, 500V, 50Hz, 3-phase, 8-pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors per slot. If the slip ring voltage on open circuit is not to exceed 400volt, find a suitable rotor winding by estimating number of slots, number of conductors per slot, coil span, slip-ring voltage on open circuit, approximate full load current per phase in rotor. Assume efficiency=90% and pf=0.86. (10)

**OR**

b (i) What are the advantages of salient pole rotor over cylindrical rotor for a 3phase synchronous machine? (6)

(ii) Design a cage rotor for a 40 HP, 3-phase 400V , 50Hz, 6 pole , delta connected induction motor having a full load efficiency of 87% and a full load pf of 0.85. Take D=33cm and L=17cm. Stator slots = 54, conductors per slot = 14. Assume suitably the missing data if any (10)

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15 a (i) Write the features of computer aided design of electrical machines. Compare: "Analysis method" and "Synthesis method". (8)

(ii) Draw the flowchart to design a rotating machines using digital computer. (8)

**OR**

b (i) Determine the main dimensions of a 3000 kVA, 6.6 kV , 50 Hz , 187.5 rpm 3 phase alternator. Also find the number of stator slot, conductor/slot and winding details. Assume $B_{av}$ = 0.58 T and ac/m=35000 (8)

(ii) Define the terms specific electric loading and specific magnetic loading as applied to electrical machines. What are the considerations in the choice of these for synchronous machines? (8)