Exam.Code:0936
Sub. Code: 33772

2056

B.E. (Electrical and Electronics Engineering)

Sixth Semester

PC-EE-605: Electric Machine Design

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. All questions carry 10 marks.*

x-x-x

1. Attempt the following:-

   a) Define specific magnetic loading and specific electric loading in electrical machine design.

   b) What factors influence the selection of flux density in the air gap of electrical machines?

   c) Explain the importance of temperature rise calculation in electrical machine design.

   d) Define continuous rating and intermittent rating of electrical machines.

   e) Why are cooling systems necessary in large electrical machines?

   f) Define EMF per turn in transformer design and explain its significance.

   g) What is meant by slot leakage flux in induction machines?

   h) Why should harmonic torques be minimized in induction motors?

   i) Define output coefficient of alternators.

   j) What are the advantages of computer aided electrical machine design (CAEMD)?

UNIT - I

2. a) Derive the general output equation of rotating electrical machines in terms of specific magnetic loading and specific electric loading.

   b) A 3-phase, 50 Hz induction motor has the following design parameters:

      Average flux density = 0.6 Wb/m^2
      Specific electric loading = 25000 A/m
      Speed = 1500 rpm

   Determine the output coefficient of the machine.

   c) Discuss the effect of specific loadings on size, efficiency and cost of machines.

3. a) Explain the methods of cooling used in electrical machines with neat diagrams.

   b) A machine has:

      Losses = 2000 W
      Heat dissipation coefficient = 12 $W/m^2{}^\circ C$
      Surface area = 2.5 m^2

   Calculate the steady state temperature rise.

   c) Discuss the factors affecting heating and cooling of electrical machines.

4. a) Derive the output equation of a transformer.

   b) A 100 kVA, 50 Hz transformer has:

Maximum flux density	=	1.3 Wb/m^2
Voltage per turn	=	10 V

   Determine:

   i) Net core area

   ii) Number of turns in the primary winding (for 11 kV side)

   c) Explain the factors affecting leakage reactance in transformers and methods used to control it.

UNIT - II

5. a) Derive the output equation of a three phase induction motor.

   b) A 3-phase, 50 Hz induction motor develops 15 kW output at 1440 rpm.

   Given:

Specific magnetic loading	=	0.55 Wb/m^2
Specific electric loading	=	30000 A/m

   Calculate the main dimensions (D and L) of the machine.

   c) Discuss the criteria for selecting stator and rotor slot numbers.

6. a) Derive the output equation of an alternator.

   b) A 3-phase alternator has the following data:

Output	=	500 kVA
Speed	=	300 rpm
Specific magnetic loading	=	0.65 Wb/m^2
Specific electric loading	=	35000 A/m

   Determine the main dimensions of the alternator.

   c) Compare salient pole and cylindrical rotor alternators from the design perspective.

7. a) Explain the design procedure of stator winding of induction motors.

   b) Discuss methods for elimination of harmonic torques in induction motors.

   c) Explain the role of computer aided design in electrical machine design and list its advantages over conventional design methods.

x-x-x