Reg. No. : ....

Name : ....

Eighth Semester B.Tech. Degree Examination, April 2016
(2008 Scheme)
08.802 : ELECTRICAL MACHINE DESIGN (E)

Time : 3 Hours　　　　　　　　　　　　　　　　　　　Max. Marks : 100

Instruction : *Answer **all** questions from Part **A** and **one full** question from **each** Module of Part **B**.*

PART – A

1. Outline the procedure for calculating no load current of a 3 φ Induction motor.

2. Derive the output equation of a 1 φ transformer.

3. Distinguish between distribution and power transformer.

4. Derive the output equation of a dc machine.

5. Explain the rules for selecting rotor slots for SCIM.

6. Compare analysis and synthesis method of CAD of electric machine.

7. A 500 KVA, 3.3 KV, 50 Hz, 600 rpm, 3 phase salient pole alternator has 180 turns per phase. Estimate the length of airgap if the average flux density is 0.54 wb/m^2. The ratio of pole arc to pole pitch : 0.65, short circuit ratio : 1.2, the gap contraction factor : 1.15, winding factor 0.955.

8. Write short notes on :
   i) Apparent and real flux density
   ii) Field form factor
   iii) Carter's airgap extension coefficient.

9. Explain briefly continuous and intermittent ratings.

10. Discuss briefly the factors affecting the choice of specific loadings of dc machine.

(10×4=40 Marks)

PART – B

Module – I

11. a) Derive the heating equation of a homogeneous body and obtain therefrom the temperature rise time curve.

b) Determine the main dimension of the core. The number of turns and cross-section of the conductor for a 5 KVA, 11000/400 V, 50 Hz, single phase core type distribution transformer. The net conductor area in the window is 0.6 times the net cross-section of iron in the core. Assume a square cross-section of the core, a flux density of 1 Wb/m², a current density 1.4 A/mm² and a window space factor 0.2. The height of the window is 3 times its width.

12. a) List out the insulating materials belonging to class B and class F as used in rotating electrical machines and state their permissible maximum temperature and temperature rises.

b) An Induction machine has a heating time constant of 100 minutes, a cooling time constant of 150 minutes and final steady temperature rise of 60°C on rated full load. Estimate the maximum temperature rise attained if the motor runs at full load for 24 minutes followed by a stationary period of 36 minutes. The cycle being repeated indefinitely.

Module – II

13. a) Discuss the factors influencing the selection of number of poles of a DC machine.

b) Calculate the mmf required for the airgap of a machine having core length = 0.32 m including 4 ducts of 10 mm each. Pole arc is 0.19 m; slot pitch = 65.4 mm; slot opening = 5 mm; airgap length = 5 mm, flux/pole = 52 mwb. Given Carter's coefficient 0.18 for opening/gap = 1 and is 0.28 for opening/gap = 2.

14. a) Give the step by step procedure for designing the shunt field winding of a DC machine highlighting the pole, coil design and temperature rise.

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

A – 2341

Module – III

15. a) Derive the output equation of a three phase Induction motor.

    b) i) Explain the effect of airgap length on the performance of a synchronous machine. Also discuss the factors to be considered while deciding the number of stator slots in a synchronous machine.

    ii) Explain the method of designing the rotor of a turbo alternator.

16. a) What are the factors to be considered in selecting the average flux density in the airgap and ampere conductors per meter for an Induction machine.

    b) A 3ϕ, 440 V, 750 rpm, 50 Hz, Y connected Induction motor has a stator with an internal diameter of 0.25 m and an axial length of 0.15 m. It has 48 slots with 24 conductors/slot. The area of each stator conductor is to be 5 mm^2. Calculate the width and depth of the slot to accommodate the stator conductors. The maximum flux density in the teeth is to be 1.7 Wb/m^2. Conductor insulation is 0.08 mm thick and slot insulation is 0.8 mm thick. Make other suitable assumptions.

(3×20=60 Marks)