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Reg. No. : .....

Name : .....

Eighth Semester B.Tech. Degree Examination, November 2015
(2008 Scheme)
08.802 : ELECTRICAL MACHINE DESIGN (E)

Time : 3 Hours Max. Marks : 100

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

PART – A

1. What are the temperature limits of different classes of Insulating materials ?
2. Explain the term "hot spot temperature" with respect to electrical machines.
3. Discuss the advantages of hydrogen as a cooling medium as compared to air.
4. What are the differences between distribution and power transformers ?
5. Distinguish between apparant flux density and real flux density in a highly saturated armature teeth.
6. Derive the output equation of a DC machine.
7. Explain the factors to be considered for the selection of specific electric loading of DC machines.
8. Explain the factors to be considered for separation of D and L for cylindrical rotor machines.
9. Derive an expression for determining the end ring current of a squirrel cage Induction Motor.
10. Compare the analysis and synthesis method of computer Aided Design of an electrical machine.

(10×4=40 Marks)

PART – B

Module – I

11. a) Derive an expression for temperature rise time curve for an electrical machine. 8

b) A 450 KVA transformer has a total loss of 7.5 kW at full load. The rate of heat dissipation from tank walls is 300 W/°C. The heat energy required to raise its temperature by 1°C is 0.5 kwh. Calculate

i) The final steady temperature rise and thermal time constant of the transformer.

ii) The half hour rating of the transformer to give the same temperature rise as in

iii) If the copper loss at full load is twice the iron loss. 12

OR

12. a) Derive the output equation of a 3 phase transformer. 5

b) Calculate the main dimensions and winding details of a 100 KVA, 2000/400V, 50Hz, single phase shell type, oil immersed, self cooled transformer. Assume,

Voltage/turn = 10

Flux density in core = 1 Wb/m^2

Current density = 2A/mm^2

Window space factor = 0.35

Ratio of height to width of window = 3

Ratio of core depth to width of central limb = 2.5. 15

Module – II

13. a) Derive the expression for MMF required for the airgap of a machine with salient poles and slotted armature. 8

b) Determine the main dimensions of a 45kW, 220V, 850 rpm, DC motor, given

Average flux density = 0.5 Wb/m^2

Ampere conductors/m = 26,000

Maximum efficiency = 90% on full load.

Field current is 2.5% of full load current. 12

OR

14. A 150 kW, 6 pole, 230 V, 500 rpm, dc short motor has an efficiency of 91%. Design the main dimensions, no. of slots, no. of conductors and dimensions of slot. The following data are available. Specific magnetic loading = 0.6, specific electric loading = 29 kA/m. 20

Module – III

15. a) Derive the output equation of a synchronous machine. 6

    b) The field coils of a salient pole alternator wound with a single layer winding of bare copper strip 30 mm deep, with separating insulation of 0.15 mm thick. Determine a suitable winding, height, no. of turns and thickness of conductor to develop an mmf of 12,000A with a potential difference of 5 V/coil and with a loss of 1200 W/m^2 of total coil surface. The mean length of turn is 1.2 m. Resistivity of copper = 0.021ohms/m and mm^2. 14

OR

16. Determine the main dimensions, turns per phase, no. of slots, conductor cross section and slot area of a 250 HP, 3 phase, 50Hz, 400 V, 1410 rpm, slip ring Induction Motor. The motor is delta connected. Assume

    Specific magnetic loading = 0.6 Wb/m^2 .

    Specific electric loading = 30,000 A/m.

    Efficiency = 0.91, and power factor = 0.85.

    Winding factor = 0.955, current density = 4 A/mm^2.

    Slot space factor = 0.4 and

    Ratio of core length to pole pitch is 1.3. 20