Code No. 6177 / O

FACULTY OF ENGINEERING

B.E. 4/4 (EEE) I – Semester (Old) Examination, November 2013

Subject : Electric Machine Design

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1. Draw the B-H curve of any soft magnetic material. (2)
2. Differentiate between Copper and Aluminum materials with respect to any 3 characteristics. (3)
3. Define 'Reluctance' of a magnetic circuit. (2)
4. What are the three modes of heat dissipation from electrical machines and give some common examples of each case? (3)
5. Define specific magnetic and electrical loadings. (2)
6. What are the advantages and disadvantages of higher number of poles in case of d.c. machine. (3)
7. Define 'Window Space Factor'. (2)
8. Calculate the dissipating surface area of a plain walled transformer tank whose dimensions are height x length x width = (12S x 100 x 50) (all in cms). (3)
9. Define 'SCR' of a synchronous machine. (2)
10. How digital computer helps to design the electrical machine? (3)

PART – B (50 Marks)

11.a) What are the properties of ideal insulating materials and classify them and explain with examples? (5)

b) Define 'permeability' and classify the magnetic materials accordingly and explain with examples. (5)

12. A 220 V, 10 K.W., 4-pole d.c. machine has the following data : (10)

Armature diameter = 0.25 mts;
Armature core length = 0.125 mts;
Length of air gap at pole centre = 2.0 mm;
Flux per pole = 11.7 m wbs
Ratio of $\frac{pole\ arc}{\text{pole pitch}} = 0.55$

Calculate the m.m.f. required for air gap :

i) If armature surface is treated as smooth
ii) If armature is slotted and gap contraction factor is 1.15

..2

13. Define 'cooling time constant' and derive the expression for quantity of cooling medium required for electrical machines. (10)

14. The tank of 100 KVA natural oil cooled transformer has the length x width x height as (0.65 x 1.55 x 1.85) mts respectively. The full load losses are 12 KW; loss due to radiation = 6W/mt^2 - ^{0}C; loss due to convection = 6.5W/mt^2 - ^{0}C. Improvement in convection due to tubes = 40%. Temperature rise = 35^{0}C length of each tube = 1mtr, diameter of each tube = 50 mm. Calculate the number of cooling tubes required for this transformer. (10)

15.a) Derive the output equation of a D.C. machine and power developed by armature when the machine is working as both generator and motor. (5)

b) Calculate the main dimensions and the no. of poles of a 25 KW, 220V, 1200 r.p.m. D.C. shunt motor, so that square pole fare is obtained. The overall gap flux density is 0.7 T and ac = 20,000 AC/mt. The ratio of pole arc to pole pitch = 0.7 Efficiency = 70%. (5)

16.a) Derive the expression for output equation of 3-Φ induction motor. (5)

b) Derive the expression for specific slot permeance of a semi-closed rectangular slot with single layer winding on it. (5)

17. Explain the synthesis and analysis methods for designing electrical machines with neat flow charts. (10)

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