

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 160804**Date: 05/01/2013****Subject Name: Electrical Machine Design****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Deduce the expression of m.m.f for the air gap of the armature for the slotting and ducting. **07**

(b) Explain the Real and Apparent flux densities. **07**

Q.2 (a) Explain the methods for estimation of m.m.f for tapered teeth. **07**

(b) Determine the air gap length of a d.c. machine from the following particulars: **07**
gross length of core=0.12m; number of ducts=one and is 10 mm wide; slot pitch=25 mm; slot width=10mm; Carter's co-efficient for slots and ducts=0.32; gap density at pole centre=0.7wb/m²; Field m.m.f per pole=3900 A, m.m.f required for iron parts of magnetic circuit=800 A.

OR

(b) Derive the expression for the leakage permeance of parallel sided slot. **07**

Q.3 (a) Calculate the m.m.f required for the air gap of a machine having core length=0.32m including 4 ducts of 10 mm each, pole arc=0.19m; slot pitch=65.4mm; slot opening=5 mm; air gap length=5 mm; flux per pole =52mWb. Given Carter's co-efficient is 0.18 for opening/gap=1 and is 0.28 for opening/gap=2. **07**

(b) Explain the heating time constant and explain how it can be evaluated from heating curve. **07**

OR

Q.3 (a) The temperature rise of a transformer is 25° after one hour and 37.5° after two hours of starting from cold conditions. Calculate its final steady temperature rise and the heating time constant. If its temperature falls from the final steady value to 40° C in 1.5 hour when disconnected, calculate its cooling time constant. The ambient temperature is 30° C. **07**

(b) Explain the methods of estimation of motor rating for variable load drives. **07**

Q.4 (a) Derive the expression for the KVA rating of a three phase transformer and show that the e.m.f per turn $E_t = K\sqrt{\text{KVA}}$. **07**

(b) Calculate approximate overall dimensions for a 200 KVA, 6600/440V, 50Hz, 3-phase core type transformer. The following data may be assumed: e.m.f per turn=10 V; maximum flux density=1.3 Wb/m²; current density =2.5 A/mm²; window space factor=0.3, overall height=overall width; stacking factor=0.9. Use a three stepped core. Width of largest stampings=0.9d, and Net iron area=0.6d² where d is the diameter of circumscribing circle. **07**

OR

- Q.4 (a)** Derive the condition for the optimum design of transformer for the minimum cost and minimum losses. **07**
- Q.4 (b)** Define specific electric loading and magnetic loading and derive the output equation of d.c.machine. **07**
- Q.5 (a)** Explain the factors affecting the choice of electrical loading. **07**
- Q.5 (b)** A 350 KW, 500 V, 450 rpm, 6 pole d.c. generator is build with an armature diameter of 0.87m and a core length of 0.32m.The lap wound armature has 660 conductors. Calculate the specific electric and magnetic loading. **07**
- OR**
- Q.5 (a)** Discuss the factors that influence the choice of number of poles of a d.c.machine. **07**
- Q.5 (b)** Find the suitable number of poles and diameter of the core of a 400 KW, 550V, 180 rpm d.c. Generator having 92% efficiency. Assume an average flux density in the air gap of about 0.6 wb/m² and ampere conductors per meter to be 35000. **07**
