Seat No.: _____ Enrolment No._____

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: 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/m^2;Field m.m.f per pole=3900 A, m.m.f required for iron parts of magnetic circuit=800 A. **07**

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^o after one hour and 37.5^o 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^o C in 1.5 hour when disconnected, calculate its cooling time constant. The ambient temperature is 30^o 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 $E_t=K\sqrt{KVA}$. **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/m^2; current density =2.5 A/mm^2; window space factor=0.3, overall height=overall width; stacking factor=0.9.Use a three stepped core. **07**

Width of largest stampings=0.9d, and

Net iron area=0.6d^2 where d is the diameter of circumscribing circle.

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**
	(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**
	(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/m^2 and ampere conductors per meter to be 35000.	**07**

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