Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI EXAMINATION – WINTER 2015

Subject Code:160804 Date:14/12/ 2015

Subject Name: Electrical Machine Design

Time:2:30pm to 5:00pm Total Marks: 70

Instructions:

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

Q.1	**(a)**	Deduce an expression for the M.M.F required for the air gap of an armature with slots and ducts.	**07**
	(b)	Describe the various methods of cooling of transformers.	**07**
Q.2	**(a)**	What are the factors that limit the design of an electrical machine?	**07**
	(b)	Explain the design procedure in the design of field windings for a D.C. shunt machine.	**07**
		OR	
	(b)	An Induction motor is heated to temperature of 60^0C and then is shut down and allowed to cool. Calculate its temperature at a time 20 minutes after the shutdown if the cooling time constant is 60 minutes. The ambient temperature is 30^0C.	**07**
Q.3	**(a)**	Derive the output equation of a single phase transformer.	**07**
	(b)	Calculate the number of turns and the cross section area of a conductor for a 100 KVA, 11000/400 Volts, 50 Hz, single phase core type transformer. Use 1.6 A/mm^2 as current density and 0.070 Wb as flux.	**07**
		OR	
Q.3	**(a)**	A D.C. shunt Generator rated for 5 KW, 4 Pole, 1500 r.p.m. is to be designed for a square pole face from the following data. Specific Magnetic Loading Bav=0.45 Wb/m^2, Specific Electric Loading ac = 15000 Amp. Conductors/m, Full Load efficiency = 85 %, ratio α = Pole Arc / Pole Pitch = 0.67, For Square Pole, Core Length L (or Width) / Pole arc = 1. Calculate D and L of Machine.	**07**
	(b)	Explain various factors affecting selection of Numbers of armature slots for D.C. machine.	**07**
Q.4	**(a)**	Explain the Real and Apparent flux densities.	**07**
	(b)	Determine the core and yoke dimensions for a 200 KVA, 50 Hz, 6600/400 Volts, 3-Phase core type transformer, with the following data is given. Maximum flux density = 1.3 Wb/m^2, Current density = 2.5 Amp/mm^2, Window Space factor = 0.3, Voltage per turn = 10 Volts, Height of Window = 3 times width of the window, Stacking factor = 0.9 and a three stepped core is used.	**07**
		OR	
Q.4	**(a)**	Derive output equation of 3 –Φ Transformer. Also Prove that $E_t = K\sqrt{Q}$	**07**

	(b)	Explain radial and axial ventilation with the help of sketches. Give the advantages of hydrogen cooling in alternators.	**07**

Q.5	**(a)**	Define specific magnetic loading (Bav) and specific electric loading (ac) and obtain an expression for the “output co-efficient" for a D.C. machine.	**07**
	(b)	Discuss the factors that determine the choice of air-gap in induction motor.	**07**

OR

Q.5	**(a)**	What are the important considerations in choosing number of poles in D.C. machine?	**07**
	(b)	Derive the condition for the optimum design of transformer for the minimum cost and minimum losses.	**07**

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