Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2016

Subject Code:170902 **Date:07/05/2016**

Subject Name:Electrical Machine Design-I

Time:02:30 PM to 05:00 PM **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)**	Write a Short Note on Duty Cycle.	**07**
	(b)	A 40 Hz transformer is to be used on a 50 Hz system. Assuming the Steinmetz's coefficient as 1.6 and losses at lower frequency 1.2% ,0.7 % and 0.5 % for I^2R, hysteresis and eddy current respectively. Find (a) losses on 50 Hz for same supply voltage and current (b) output at 50 Hz for same total losses as on 40 Hz.	**07**
Q.2	**(a)**	Discuss the factors affecting the selection of specific magnetic and specific electric loadings in dc machine design.	**07**
	(b)	Determine main dimensions (D and L) of a 12 kW, 230V, 2 pole, 1500 rpm D.C. shunt generator. The required data is full load efficiency = 82% , pole arc/pole pitch = 0.63, avg. flux density = 0.4 Wb/m^2, Ampere conductors / m =19000. Machine is designed to have square pole face.	**07**
		OR	
	(b)	Explain Commutation in dc machine. Explain how interpole improves it ?	**07**
Q.3	**(a)**	Discuss the factors affecting the selection of number of poles in D.C.machine	**07**
	(b)	Briefly explain the principles of core design of a current transformer.	**07**
		OR	
Q.3	**(a)**	Discuss the behavior of current transformer under system short circuit.	**07**
	(b)	The armature of 12 pole , 500kW, 550V, generator has a simplex lap winding consisting of 2484 conductors. There are 621 commutator segments & ratio of pole arc to pole pitch is 0.7. (a) Calculate the demagnetizing & cross magnetizing mmf / pole at rated full load current if brushes are shifted through 3 segments from G.N.A. (b) Calculate no. of conductors that must be provided in each pole face if a compensating winding is used.	**07**
Q.4	**(a)**	Estimate the leakage reactance of concentric winding in core type transformers clearly stating the assumptions used.	**07**
	(b)	Determine the main core & yoke dimensions for a 200 KVA, 50 Hz, 1-phase core type transformer. Window space factor = 0.32 , Current density = 3 A/mm^2 , Max. flux density = 1.1 Wb/m^2, Volts per turn = 14 V , Stacking factor = 0.9, Net iron area = $0.56d^2$ Cruciform core with distance between adjacent limbs = 1.6 times width of core.	**07**
		OR	
Q.4	**(a)**	Explain types of mechanical forces are developed in transformer windings?	**07**

	(b)	A 4 pole generator supplies a current of 140 A. It has 480 armature conductors (a) wave connected, (b) lap connected. The brushes are given an actual lead of 10°. Calculate the cross and demagnetizing mmf per pole in each case. The field winding is shunt connected and takes a current of 10 A, find the number of extra shunt field turns to neutralize the demagnetization.	**07**
Q.5	**(a)**	Write short note on classification of insulating materials.	**07**
	(b)	Explain design aspects of C.T	**07**

OR

Q.5	**(a)**	List out different types of winding used in 3- phase transformer with its voltage rating. Also explain cross over winding and continuous disc type winding for 3- phase transformer.	**07**
	(b)	What is design optimization? Derive necessary condition for designing a transformer with minimum cost.	**07**

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