Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (OLD) EXAMINATION – WINTER 2018

Subject Code: 170902 **Date: 19/11/2018**

Subject Name: Electrical Machine Design-I

Time: 10:30 AM TO 01:00 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)**	Derive the output equation DC machine. Also explain the factors affecting the size of rotating machine.	**07**
	(b)	Explain the factors to be considered while selecting the number of poles in the design of DC machine.	**07**
Q.2	**(a)**	Discuss factors to be considered while deciding the length of air gap in the design of a d.c. machine.	**07**
	(b)	What is the importance of temperature as a factor in the life of insulating material? Also classify insulating material as per I.S specification.	**07**
		OR	
	(b)	Determine the main dimensions, number of poles and length of air gap of a 600 kW, 500 V, 900 r.p.m. generator. Assume average gap density as 0.6 Wb/m^2 and ampere conductors per metre as 35000. The ratio of pole arc to pole pitch is 0.75 and efficiency is 91 percent. The following are the design constraints: peripheral speed: ≤ 40 m/s, frequency of flux reversals: ≤50 Hz, current per brush arm: ≤ 400 A and armature mmf per pole ≤ 7500 A. The mmf required for air gap is 50 percent of armature mmf and gap contraction factor is 1.15	**07**
Q.3	**(a)**	Explain different types of duties and rating for rotating electrical machines.	**07**
	(b)	Explain guidelines or guiding factors used for the selection of number of armature slots in d.c. machine design.	**07**
		OR	
Q.3	**(a)**	Describe the methods adopted to reduce the effect of armature reaction in DC machine.	**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.4	**(a)**	What is design optimization? Derive necessary condition for designing a transformer with minimum cost.	**07**
	(b)	Derive the output equation of a 3-phase core type transformer.	**07**
		OR	
Q.4	**(a)**	Answer the following with respect to transformer design: (i) Why cores are stepped? (ii) Why yoke is designed for low flux density? (iii) Why circular coils are preferred in transformer winding?	**07**
	(b)	Calculate approximate overall dimensions for a 200 kVA, 6600/440V, 50 Hz, 3 phase core type transformer. The following data may be assumed: emf per turn=10V; 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 3 stepped core.	**07**

For a 3 stepped core,
Width of largest stamping=0.9d and
Net iron area= 0.6d2, where d=diameter of circumscribing circle.

Q.5	**(a)**	Explain the steps involved to calculate no load current of a 3-phase transformer from its design data.	**07**
	(b)	Obtain the expression of leakage reactance of a 3-phase core type distribution transformer	**07**

OR

Q.5	**(a)**	Discuss the steps for designing a shunt field winding of a dc machine.	**07**
	(b)	Discuss the importance of mitred joints in the core assembly of transformers.	**07**

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