Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI EXAMINATION – SUMMER 2020

Subject Code: 2160912 **Date:02/11/2020**

Subject Name: Design of DC Machines and Transformer

Time: 10:30 AM TO 01:30 PM **Total Marks: 70**

Instructions:

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

			MARKS
Q.1	**(a)**	Define the following words related to transformer design: (I) Window space factor (II) Staking factor (III) Circumscribing Circle	**03**
	(b)	State factor to be considered for selection of specific loading.	**04**
	(c)	Determine the main dimensions of core and yoke for a 200 KVA, 50 Hz, 1-phase core type transformer. Use the following data: Window space factor=0.32, Current density=3A/mm^2, Maximum flux density=1.1 Wb/m^2, Voltage per turn=14 V, Stacking factor=0.9.Net iron area=0.56d^2, where d is the diameter of circumscribing circle. The cruciform core is used with the distance between adjacent limbs=1.6 times width of core lamination. The width of the largest stamping is 0.85d.	**07**
Q.2	**(a)**	Give the comparison between core and shell type transformers.	**03**
	(b)	Differentiate between Radial Forces and Axial Forces in transformer windings.	**04**
	(c)	Derive the expression of leakage reactance of a 3-phase core type distribution transformer.	**07**
		OR	
	(c)	Write a short note on the classification of insulating materials**.**	**07**
Q.3	**(a)**	Explain the importance of stepped core in the transformer.	**03**
	(b)	Why tapping's are generally provided on HV winding?	**04**
	(c)	What is design optimization? Derive necessary condition for designing a transformer with minimum cost.	**07**
		OR	
Q.3	**(a)**	How to reduce the demagnetizing effects and cross-magnetizing effect?	**03**
	(b)	Give the comparison between the power transformer and distribution transformer.	**04**
	(c)	A 200 kVA, 6600/440volts, 50Hz, three phase core type transformer has the following design data: Max. flux density : 1.3 wb/m^2, EMF/Turn : 10 volts, Stacking factor : 0.9, Window space factor : 0.3 , Current density: 2.5 A/mm^2. Overall width and overall height are the same. If three stepped core is used to determine overall dimensions.	**07**
Q.4	**(a)**	Explain the heating of electrical machines.	**03**
	(b)	Explain how the following factors influence the main dimensions of a DC Machine.	**04**

(1) Peripheral speed (2) voltage between adjacent segments

	(c)	Derive the output equation of a 3-phase core type transformer.	**07**

OR

Q.4	**(a)**	Explain Staggering of Brushes in a D.C. machine.	**03**
	(b)	Why Circular Coils are preferred in Transformer?	**04**
	(c)	Explain various factors affecting the selection of airgap length in the D.C. machine.	**07**
Q.5	**(a)**	Explain the disadvantages of having higher specific electric loading in DC Machine Design.	**03**
	(b)	Which type of material is preferred for core laminations in transformer? What is the advantage of using a mitred joint in the core construction?	**04**
	(c)	Calculate the diameter and length of the armature for a 7.5kW, 4 poles, 1000 r.p.m, 220 V shunt motor. Given: full load efficiency= 0.83; maximum gap flux density=0.9 Wb/m^2: specific electric loading=30,000 ampere conductors per meter; field form factor = 0.7. Assume that the maximum efficiency occurs at full load and field current is 2.5% of rated current. The pole face is square.	**07**

OR

Q.5	**(a)**	Discuss the necessity of inter-pole in D. C. machine design.	**03**
	(b)	Explain the losses at the commutator surface.	**04**
	(c)	Design is required for a 50 kW, 4 poles, 600 r.p.m. D.C. shunt generator, the full load terminal voltage being 220 V. If the maximum gap density is 0.83 Wb/m^2 and the armature ampere conductors per meter are 30,000, calculate suitable dimensions of armature core to give a square pole face. Assume that the full load armature voltage drop is 3 per cent of the rated terminal voltage and that the field current is 1 per cent of rated full load current. The ratio of pole arc to pole pitch is 0.67.	**07**

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