Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2017

Subject Code: 2160912 Date:03/11/2017

Subject Name:Design of DC Machines and Transformer

Time:02:30 PM TO 05:30 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4.

Q.1*	**(a)**	Give the comparison between core and shell type transformers.	**03**
	(b)	Derive equation Et = k√Q where Q = kVA rating of a transformer. Explain how service conditions of transformer affect the value of K.	**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. Cruciform core is used with distance between adjacent limbs=1.6 times width of core lamination. The width of the largest stamping is 0.85d.	**07**
Q.2	**(a)**	Explain the importance of stepped core in transformer.	**03**
	(b)	Explain why tapings are usually provided on HV side in a transformer.	**04**
	(c)	What is design optimization? Derive necessary condition for designing a transformer with minimum cost.	**07**
		OR	
	(c)	A 250KVA, 6600/400 V, 3-Phase core type transformer has a total loss of 4800 W at full load. The transformer tank is 1.25 m in height and 1m x 0.5m in plan. Designs a suitable scheme for tubes if the average temperature rise is to be limited to 35 ^oC.The diameter of tubes is 50 mm and is spaced 75 mm from each other. The average height of the tube is 1.05 m.Specific heat dissipation due to radiation and convection is respectively 6 and 6.5 W/m^2-^0C.Assume that convection is improved by 35% due to provision of tubes.	**07**
Q.3	**(a)**	Give the comparison between power transformer and distribution transformer.	**03**
	(b)	What are the major losses in transformer? Derive the condition for getting maximum efficiency of a transformer.	**04**
	(c)	Explain various factors affecting the choice of specific electric loading in the design of DC machine.	**07**
		OR	
Q.3	**(a)**	Derive the output equation of a DC machine.	**03**
	(b)	Explain how the following factors influence the main dimensions of a DC Machine. (1) Peripheral speed (2) voltage between adjacent segments.	**04**
	(c)	Explain various factors affecting selection of number of poles for DC machines.	**07**
Q.4	**(a)**	Explain briefly why the length of air-gap is not uniform under the entire pole arc in a DC machine?	**03**
	(b)	Explain the factors affecting the size of rotating machines.	**04**
	(c)	Calculate the diameter and length of armature for a 7.5 KW,4 Pole,1000 RPM,220 V, DC Shunt Motor.Given: full load efficiency=0.83, maximum gap flux density=0.9 Wb/m^2, specific electric loading=30,000 A/m, field form factor=0.7.Assume that the	**07**

maximum efficiency occurs at full load and the field current is 2.5% of the rated current. The pole face is square.

OR

Q.4	**(a)**	Which type of material is preferred for core laminations in transformer? What is the advantage of using mitred joint in the core construction?	**03**
	(b)	Explain the functions of conservator and breather in transformer.	**04**
	(c)	Explain different methods used to improve armature reaction effect in D.C. machines.	**07**
Q.5	**(a)**	List out various factors affecting the choice of length of air-gap in DC machines. Explain any two.	**03**
	(b)	Explain the factors affecting the choice of flux density and current density in the design of transformer.	**04**
	(c)	How will the output, losses and efficiency in transformer vary with linear dimensions?	**07**

OR

Q.5	**(a)**	Explain briefly about the design of core in current transformers.	**03**
	(b)	Prepare a technical note on classification of insulating materials	**04**
	(c)	Explain steps to design shunt field winding of a d.c. machine.	**07**

.

****