Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(OLD) • EXAMINATION – WINTER 2016

Subject Code: 170902 **Date: 21/11/2016**

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)** Determine the main dimensions of core and window for a 500KVA, 66000/400V, 50Hz, single phase core type, oil immersed , self cooled transformer . Assume: flux density =1.2T. Current density =2.75 A/mm^2, window space factor=0.32,Volt/turn=16.8,type of core: cruciform, height of window=3 times window width . Also calculate the number of turns and cross-sectional area of the conductors used for primary and secondary windings. **07**

(b) Transformer A and B are of same type and have equal current density, flux density, frequency and window space factor. Their linear dimensions are in the ratio of 2:1. Prove that their losses will be in the ratio of 8:1. **07**

Q.2 **(a)** A 3 phase 15 MVA, 33/6.6 KV, 50 Hz, star/delta core type oil immersed natural cooled transformer gave the following results during design calculations. Length of core + two times heights of yoke= 250cm, centre to centre distance of cores= 80cm , outside diameter of the HV winding = 78.5cm,iron losses =26 Kw, copper losses in LV & HV windings =41.5 KW & 57.% Kw respectively . calculate the main dimension of the tank, temperature rise of the transformer without cooling tubes and numbers of tubes for a temperature rise not exceed 50°c.comment upon whether tubes can be used in a practical case for such a transformer. If not suggest the change. **07**

(b) Derive output equation of 3 –Φ Transformer. Write the significance of constant 'K'. **07**

OR

(b) Explain technical reasons for : **07**
(1) Low flux density is selected for yoke of a three phase transformer.
(2) Circular coils are preferred in transformer winding.
(3) Tapings are usually provided on h.v. side of transformer.

Q.3 **(a)** Estimate the leakage reactance of concentric winding in core type transformers clearly stating the assumptions used. **07**

(b) Write a Short Note on : Duty Cycle **07**

OR

Q.3 **(a)** Explain effect of change in frequency on losses, voltage & leakage impedance of transformer **07**

(b) Explain steps to design shunt field winding of a d.c. machine **07**

Q.4 **(a)** Explain how following points affect the dimensions of slots in a d.c. machine armature design. **07**
(1) Excessive flux density
(2) Flux pulsations
(3) Eddy current losses
(4) Mechanical issues

	(b)	Explain types of mechanical forces are developed in transformer windings?	**07**
		OR	
Q.4	**(a)**	Discuss factors to be considered while deciding the length of air gap in the design of a D.C. machine.	**07**
	(b)	Explain how pole body height is fixed while designing field system of a d.c. machine.	**07**
Q.5	**(a)**	Explain various factors affecting selection of number of poles for D.C. machine	**07**
	(b)	Briefly explain the principles of core design of a current transformer	**07**
		OR	
Q.5	**(a)**	Explain : a. Significance of mitred joints in transformer. b. Design difference between power & distribution transformer	**07**
	(b)	Define specific electric and specific magnetic loading. Also state advantage sand disadvantages of these loadings.	**07**

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