Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – SUMMER • 2014

Subject Code: 160804 Date: 28-05-2014

Subject Name: Electrical Machine Design

Time: 10:30 am - 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)**	Deduce an expression for the m.m.f required for the air gap of an armature with slots and ducts.	**07**
	(b)	Explain with necessary diagrams different cooling methods used for transformer.	**07**
Q.2	**(a)**	Define heating time constant and explain how it can be evaluated from heating curve.	**07**
	(b)	State the advantages of hydrogen cooling in alternators. Explain radial and axial ventilation with the help of sketches.	**07**
		OR	
	(b)	Deduce an expression for the design of core for Square and cruciform sections also state the reason why circular coils are always preferred in comparison to rectangular coils.	**07**
Q.3	**(a)**	Determine the dimension of the core and yoke for a 200 kVA, 50Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume: voltage per turn 14 V, maximum flux density 1.1Wb/mm^2. window space factor .32, current density 3amp/mm^2 and stacking factor = .9 The net iron area is .56d^2 in a cruciform core where d is the diameter of circumscribing circle. Also width of largest stamping is .85d	**07**
	(b)	Derive output equation of 3 –Φ Transformer. Write significance of constant 'K'.	**07**
		OR	
Q.3	**(a)**	Show that for minimum total material cost of a 3-phase transformer the ratio (Weight of iron/Weight of copper) should be equal to the ratio (specific cost of Copper (Rs. /kg) / specific cost of iron ((Rs. /kg))	**07**
	(b)	Calculate the main dimensions of 125kVA 6.610kV, 50Hz single phase shell type transformer. Taking: Voltage per turn = 10V; flux density in core = 1.1Wb/m^2; current density J = 2 amp/mm^2; window space factor Kw = .33; stacking factor K = .9; height of Window Hw = 3xWidth of window Ww core depth = 2.5 width of central limb(2a); also find size of conductor.	**07**
Q.4	**(a)**	Define specific magnetic loading (Bav) and specific electric loading (ac) and obtain an expression for the "output co-efficient for a d.c. machine.	**07**
	(b)	Explain various factors affecting selection of Numbers of armature slots for D.C. machine.	**07**
		OR	
Q.4	**(a)**	What are the important considerations in choosing number of poles in D.C. machine	**07**
	(b)	Explain the design procedure in the design of field windings for a D.C. shunt machine.	**07**
Q.5	**(a)**	Discuss the factors that determine the choice of air-gap in induction motor.	**07**
	(b)	What are the factors that limit the design of an electrical machine?	**07**
		OR	
Q.5	**(a)**	Explain how eddy current loss occurs and derive an expression for eddy current loss in a magnetic material.	**07**
	(b)	What are the factors that affect the size of rotating machines? (04) Mention various factors on which brush friction loss depends.(03)	**07**

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