Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3170909 Date:11-12-2024

Subject Name:AC Machine Design

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	List out different types of windings in 3 phase transformers. Explain sandwich winding.	**03**
	(b)	Define SCR and its importance in designing of synchronous machine.	**04**
	(c)	Derive an output equation for 3-ϕ induction motor with usual notation	**07**
Q.2	**(a)**	Why stepped core is used in transformers?	**03**
	(b)	State why a turbo alternator has smaller diameter and large length but hydro alternator has larger diameter and small length?	**04**
	(c)	Explain heating of electrical machines.	**07**
		OR	
	(c)	Write a short note on Duty Cycle.	**07**
Q.3	**(a)**	What are the salient features of a Distribution transformer?	**03**
	(b)	State the effect of air gap length on the performance of a 3-phase induction motor.	**04**
	(c)	Determine the main dimensions of the core for a 5 kVA , 11000/400 V, 50 Hz, single phase core type distribution transformer. The net conductor area in the window is 0.6 times the net cross section of iron in the core. Assume a square cross-section for the core, a flux density 1 Wb/m2 , a current density 1.4 A/mm2,and a window space factor 0.2. The height of window is 3 times its width.	**07**
		OR	
Q.3	**(a)**	Describe importance of mitered joints in transformer.	**03**
	(b)	Explain the effect of skewing the rotor slots in a squirrel cage induction motor.	**04**
	(c)	Derive the expression of leakage reactance of a 3 phase core type distribution transformer.	**07**
Q.4	**(a)**	Discuss the factors affecting the choice of specific Magnetic loading in case of a induction motor.	**03**
	(b)	Explain the factors to be considered while selecting number of stator slots in the design of a synchronous machine.	**04**
	(c)	Describe the design procedure of stator in case of 3 phase induction motor.	**07**
		OR	
Q.4	**(a)**	Explain direct axis and quadrature axis synchronous reactance in synchronous machine	**03**
	(b)	What is the role of damper winding in (i) synchronous generator and (ii)synchronous motor?	**04**

	(c)	A 22kW,3 phase,4 pole 50 Hz,415V star connected induction motor has 48 slots each containing 20 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 55. The machine efficiency of 0.88 and a power factor of 0.89. The rotor mmf may be assumed of 85 percent of stator mmf. If current density is 6 A/mm2 find area of rotor bar and area of end ring.	**07**
Q.5	**(a)**	Discuss cooling methods of large turbo alternators.	**03**
	(b)	Discuss application of FEM technique for design problems	**04**
	(c)	What is design optimization? Derive necessary condition for designing a transformer with minimum cost.	**07**

OR

Q.5	**(a)**	Enlist different methods for computer aided machine design. Discuss any one.	**03**
	(b)	Explain significance of FEM in design problem.	**04**
	(c)	write a flow chart for designing main dimentions of 3 phase Induction Motor.	**07**

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