Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022

Subject Code:3170909 Date:07-01-2023

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)**	Explain the phenomena of heat dissipation in various Electrical machines.	**03**
	(b)	Prepare a list of class of insulating materials along with their temperature withstand capability and applications	**04**
	(c)	Explain the factors affecting the choice of specific magnetic loading and specific electric loading for the design of rotating electrical machines.	**07**
Q.2	**(a)**	What is window space factor? Write the empirical formula used to estimate the value of space factor.	**03**
	(b)	Justify the statement "Area of Yoke in a transformer is generally 15-20% more than area of core".	**04**
	(c)	Find the main dimensions of a 15 kW, 3-phase, 400 V, 50 Hz, 2810 r.p.m squirrel cage induction motor having an efficiency of 0.88 and a full load power factor of 0.9. Assume: Specific magnetic loading = 0.5 Wb/m2, specific electric loading = 25000 A/m, winding factor = 0.955. Take the rotor peripheral speed as approximately 20 m/s at synchronous speed.	**07**
		OR	
	(c)	Determine the dimensions of core and yoke for a 200 KVA, 50 Hz 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 1.1 wb/m^2, window space factor 0.32, current density 3 A/mm^2, the stacking factor =0.9. The net iron area is $0.56d^2$ in a cruciform core where d is the diameter of circumscribing circle. Also the width of largest stamping is 0.85d.	**07**
Q.3	**(a)**	State the rules for the selection of rotor slots in 3-phase slip ring induction motor.	**03**
	(b)	Draw and explain the current distribution waveform spread over one pole pitch in bars and end rings in a squirrel cage induction motor.	**04**
	(c)	Derive the equation Et=K$\sqrt{Q}$, from first principles where Q= KVA rating of the transformer.	**07**
		OR	
Q.3	**(a)**	State the rules for the selection of rotor slots in 3-phase squirrel cage type induction motor.	**03**
	(b)	Briefly describe harmonic torques in 3-ϕ induction motor and its effect on the performance of the motor.	**04**

	(c)	A 75 KW, 3300 V, 50 Hz, 8 pole, 3 phase star connected induction motor has a magnetizing current which is 35 percent of the full load current. Calculate the value of stator turns per phase if the mmf required for flux density at 30 degree from pole axis is 500 A.	**07**
Q.4	**(a)**	Give comparison of salient pole and non-salient pole synchronous machine in terms of design parameters.	**03**
	(b)	Give comparison between power transformer and distribution transformer in terms of construction, design and applications.	**04**
	(c)	Determine the main dimensions for a 100 MVA, 11 kv, 50Hz, 3 phase, 150 rpm alternator. The Bav = 0.65 wb/m^2 and ac= 40000 A/m. The peripheral speed should not exceed 65m/s at normal speed in order to limit the runaway peripheral speed.	**07**
		OR	
Q.4	**(a)**	Explain Short Circuit Ratio and its significance for a synchronous machine.	**03**
	(b)	Explain the importance of damper winding in synchronous machine.	**04**
	(c)	What do you mean by the output equation? Derive the output equation of an alternator from first principles.	**07**
Q.5	**(a)**	Explain the construction and significance of any one joint in case of the core assembly of a transformer.	**03**
	(b)	Explain the terms “critical speed” and “run away speed” with reference to synchronous machine.	**04**
	(c)	Briefly explain cooling methods of transformers.	**07**
		OR	
Q.5	**(a)**	What are the applications of FEM technique for design problems?	**03**
	(b)	Explain use of any one open source FEM software for 2D design.	**04**
	(c)	Draw the flowchart for design of a transformer	**07**

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