Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2025

Subject Code:2170909 Date:08-05-2025

Subject Name:Design of AC Machines

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

			Marks
Q.1	**(a)**	Explain the concept of output equation in the design of a three-phase induction motor.	**03**
	(b)	Discuss the factors influencing the choice of specific loadings in the design of 3-ph. induction motors.	**04**
	(c)	Design the stator for a 10 HP, 400 V, 50 Hz, 4-pole three-phase induction motor. Calculate the number of turns per phase, stator slot area, total number of stator slots, and stator core length.	**07**
Q.2	**(a)**	Explain the rules for selecting the number of rotor slots in a squirrel cage rotor.	**03**
	(b)	Discuss how rotor slots can be designed to minimize harmonics in induction motors.	**04**
	(c)	Design the rotor for a 15 HP, 400 V, 50 Hz, 4-pole three-phase induction motor. Calculate only the number of rotor slots, cross-sectional area of rotor conductors.	**07**
		OR	
	(c)	Design the rotor for a 20 HP, 400 V, 50 Hz, 6-pole three-phase induction motor with a wound rotor. Calculate the number of rotor slots, number of turns, and cross-sectional area of rotor conductors.	**07**
Q.3	**(a)**	Outline the main dimensions in the design of a single-phase induction motor.	**03**
	(b)	Explain the design of auxiliary winding in a single-phase induction motor.	**04**
	(c)	Calculate the capacitance required for maximum torque in the design of a single-phase induction motor with a rated power of 5 HP, 230 V, and 50 Hz.	**07**
		OR	
Q.3	**(a)**	State the methods of improving starting torque of three phase induction motor.	**03**
	(b)	Explain the importance of conductor's area in stator design.	**04**
	(c)	What is dispersion coefficient? Explain its effect on maximum power factor.	**07**
Q.4	**(a)**	Explain the output equation and design of main dimensions in synchronous machine design.	**03**
	(b)	Describe the armature winding design for synchronous machines.	**04**
	(c)	Determine the full load field MMF and design the field winding for a 500 KVA, 3-phase, 11 KV synchronous machine.	**07**

OR

Q.4	**(a)**	Explain the difference between turbo and hydro alternator in a point of view of design.	**03**
	(b)	Define SCR and its importance in designing of synchronous machine.	**04**
	(c)	Design the main dimensions, stator, and rotor of a turbo alternator for a 20 MW, 11 KV, 50 Hz generator. Calculate the length of the air gap.	**07**
Q.5	**(a)**	Introduce the Finite Element Method (FEM) and its applications in the design of electrical machines.	**03**
	(b)	Discuss the advantages of using open-source FEM software for 2D design in electrical machine design.	**04**
	(c)	Compare different 1-phase induction motor in a point of view of design.`	**07**

OR

Q.5	**(a)**	Derive the equation of MMF of damper winding.	**03**
	(b)	Explain main differences between design of 1-ϕ and 3-ϕ induction motor	**04**
	(c)	Write the steps and necessary equations for armature design of a synchronous machine.	**07**

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