Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3170909 Date:06/06/2022

Subject Name:AC Machine Design

Time:02:30 PM TO 05:00 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.**

Q.1	**(a)**	Explain heat dissipation in Electrical Machines.	**03**
	(b)	Explain the factors for choice of specific magnetic loading & specific electric loading.	**04**
	(c)	Discuss magnetic material and insulating material in detail.	**07**
Q.2	**(a)**	Define window space factor and stacking factor. Which factor affecting window space factor?	**03**
	(b)	Describe design of LV winding of transformer.	**04**
	(c)	Explain design of cooling tank with cooling tubes in transformer.	**07**
		OR	
	(c)	What is Dispersion coefficient? Explain the effect of Dispersion coefficient on maximum power factor.	**07**
Q.3	**(a)**	Which points are to be considered for selecting number of stator slots in IM?	**03**
	(b)	Discuss factors affecting air gap length in induction motor design.	**04**
	(c)	Determine the main dimensions and number of stator turns per phase of a 3.7 kW, 400 V, 3-phase, 50 Hz, 4 pole squirrel cage induction motor having an efficiency of 0.85 and full load power factor of 0.84. Assume: Specific magnetic loading = 0.45 Wb/m^2, specific electric loading = 23000 A/m, winding factor = 0.955, stacking factor=0.9. Induction motor to be started by star delta starter and design for minimum cost.	**07**
		OR	
Q.3	**(a)**	State the rules for the selection of rotor slots in 3-phase squirrel cage induction motor.	**03**
	(b)	What is effect of harmonic induction torque and harmonic synchronous torque on the performance of 3-ph induction motor.	**04**
	(c)	Determine overall dimensions for a 200 kVA , 6600/440 V, 50 Hz, 3-phase core type transformer. Emf per turn is 10V, maximum flux density 1.3 Wb/m^2, current density 2.5 A/mm^2 , window space factor 0.3. overall height =overall width, stacking factor=0.9. For three stepped core : width of largest stamping is 0.9d and net iron area=$0.6d^2$, where d is diameter of circumscribing circle.	**07**
Q.4	**(a)**	Enlist the factors for choice of specific magnetic loading and specific electric loading in synchronous machine.	**03**
	(b)	Discuss steps for field winding design of salient pole synchronous machine.	**04**
	(c)	Find main dimensions and peripheral speed of a 2500 kVA, 3 phase, 50 Hz, 3000 V, 187.5 rpm salient pole synchronous generator. The specific magnetic loading is 0.6 Wb/m^2. specific electrical loading is 34000 A/m, winding factor is 0.955. Use circular poles with ratio of core length to pole pitch=0.65.	**07**

OR

Q.4	**(a)**	How MMF is calculated for magnetic circuit in synchronous machine?	**03**
	(b)	Explain design of damper winding in Synchronous machine.	**04**
	(c)	What is SCR? Discuss its effect on synchronous machine performance.	**07**
Q.5	**(a)**	Derive an output equation for 3-ϕ transformer.	**03**
	(b)	Derive an output equation for 3-ϕ induction motor with usual notation.	**04**
	(c)	What are the applications of FEM technique for design problem? Explain the advantages of finite element method.	**07**

OR

Q.5	**(a)**	Distinguish between Distribution transformer and Power transformer.	**03**
	(b)	Explain FEM software for design of machines.	**04**
	(c)	A 11 kW, 3-phase, 220V, 50 Hz, 6-pole star connected induction motor has 54 stator slots, each containing 9 conductors. Number of rotor bars is 64. The machine has efficiency of 0.86 and a power factor of 0.85. The rotor mmf is 85 percent of stator mmf. Determine bar current and end ring current. If current density is 5 A/mm^2, find area of bar and end ring.	**07**

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