GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3170909   **Date:16-12-2023**
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 effect of change in frequency on losses of transformer.	03
	(b)	What is the role of damper winding in (i) synchronous generator and (ii)	04
	(c)	Derive the output equation of a 3-phase core type transformer	07
Q.2	(a)	Why semi-enclosed slots are usually preferred for induction motors	03
	(b)	Explain design difference between power transformer and distribution transformer	04
	(c)	What is design optimization? Derive the condition for maximum efficiency of a transformer	07

OR

	(c)	Design a 10HP, 440V, 3-Phase, 4-pole, 50Hz squirrel cage induction motor which is to be started using a star-delta starter. Find the main dimensions (D & L) . Assume: -Average flux density in the gap=0.45wb/m2, Ampere conductors per meter=23000, efficiency=0.85, Power factor=0.84, stator winding factor=0.955. Take ratio (L/τ) = 1.0	07

Q.3	(a)	Give technical reason for low flux density for yoke of a three-phase transformer	03
	(b)	List out effects of harmonics on performance of 3 ph I.M.	04
	(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/m2, Window space factor 0.32, current density 3 A/mm2 and stacking factor = 0.9. The net iron area is 0.56 d2 in a cruciform core where d is the diameter of circumscribing circle. Also the width of largest stamping is 0.85 d.	07

OR

Q.3	(a)	Explain the terms "critical speed" and "run away speed" with reference to synchronous machine.	03
	(b)	How will the output and losses in a transformer vary with the linear dimensions?	04
	(c)	Draw and explain briefly the current distribution wave form speeded over one pole pitch in bars and end rings squirrel cage induction motor	07

Q.4	(a)	Explain design considerations to eliminate harmonics in synchronous machines.	03
	(b)	State the rules for the selection of rotor slots in 3-phase squirrel cage induction motor.	04

(c)	A 11 kW,3 phase, 6 pole 50 Hz, 220 V star connected induction motor has 54 stator slots each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine efficiency of 0.86 and a power factor of 0.85. 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**

OR

Q.4	**(a)**	Explain: Bracing in transformer winding.	**03**
	(b)	Explain the factors that affect the choice of specific magnetic loading in case of a induction motor	**04**
	(c)	A 600 rpm, 50 Hz, 10000 V, 3 phase, synchronous generator has the following design data. Bav = 0.48 Wb/m2, Current Density = 2.7 amp/mm2, slot space factor = 0.35, number of slots = 144, slot size = 120 x 20 mm, D = 1.92 m and L = 0.4 m. determine the KVA rating of the machine	**07**

Q.5	**(a)**	Briefly discuss factors affecting determining air gap length in induction motor design.	**03**
	(b)	Explain significance of FEM in design problem.	**04**
	(c)	Define SCR and its importance in designing of synchronous machine.	**07**

OR

Q.5	**(a)**	Explain the difference between turbo and hydro alternator in a point of view of design.	**03**
	(b)	Explain the factors that affect the choice of specific electric loading in case of a induction Motor.	**04**
	(c)	Write a note on computer aided design of Transformer. Explain algorithm steps to find main dimensions.	**07**

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