Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2170909 **Date:05/05/2018**

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.**

			MARKS
Q.1	**(a)**	Explain the factors that affect the choice of specific magnetic loading in case of a induction machine.	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)**	Explain the factors that affect the choice of specific electric loading in case of a induction machine.	03
	(b)	Discuss briefly the Harmonic torque in 3-ϕ induction motor	04
	(c)	Find the main dimensions, number of stator turns per phase & number of stator slots for a 25KW, 415V, 50Hz, 2880rpm,3-ϕ delta connected induction motor. Assume that: specific magnetic loading=0.48wb/m2, specific electric loading=21000ac/m, Efficiency=88%, power factor=0.87, stator winding factor=0.9451. Take ratio (L/τ)=0.7	07
		OR	
	(c)	Determine the D and L of a 70 Hp, 415V, 3-phase, 50-Hz, star connected, 6 pole induction motor for which ac = 30000 amp.cond/m and Bav = 0.51 wb/m2. Take Efficiency = 90 % and pf = 0.91. Assume Pole pitch τ = L. Estimate the number of stator conductors required for a winding in which the conductors are connected in 2-parallel paths. Choose a suitable number of conductors/ slots, so that the slot loading does not exceed 750 amp. cond.	**07**
Q.3	**(a)**	State the rules for the selection of rotor slots in 3-phase squirrel cage induction motor.	**03**
	(b)	Describe the methods for reducing the effect of harmonics torque in 3-phase squirrel cage induction 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**
		OR	
Q.3	**(a)**	Explain the difference between turbo and hydro alternator in a point of view of design.	**03**
	(b)	Explain the factors affecting the choice of specific Magnetic loading in case of a Synchronous machine.	**04**
	(c)	Find the main dimensions, number of turns per phase & number of stator slots of 3-ϕ, 13750V,50Hz,	**07**

1500 RPM, star connected alternator from given data : . Bav= 0.62 Wb/m2, ac=40000 Amp-cond/m, Kw=0.95, peripheral velocity= 79m/s., Rating=12MVA.

Q.4	**(a)**	Derive the equation of MMF of damper winding.	**03**
	(b)	Explain the terms "critical speed" and "run away speed" with reference to synchronous machine.	**04**
	(c)	Calculate the diameter, core length, no of conductors of the stator , size of conductor, no of stator slots of 75 MVA, 96 pole,50 HZ,low speed star connected hydro generator having voltage per phase is 8000V. Assume Bav= 0.64 Wb/m2, ac=40625 Amp-cond/m, Kw=0.955, peripheral velocity= 39.5m/s	**07**

OR

Q.4	**(a)**	State why a turbo alternator has smaller diameter and large length but hydro alternator has larger diameter and small length?	**03**
	(b)	Explain briefly the methods for improving e.m.f. wave form of an alternator.	**04**
	(c)	Write the steps and necessary equations for rotor design of an synchronous machine	**07**
Q.5	**(a)**	Explain main differences between design of 1-phase and 3-phase induction motor.	**03**
	(b)	Explain application of FEM technique for design problems.	**04**
	(c)	Derive an output equation for 3-ϕ induction motor with usual notation.	**07**

OR

Q.5	**(a)**	Compare the output equation of both 1-phase and 3-phase IM.	**03**
	(b)	Explain significance of FEM in design problem.	**04**
	(c)	Compare different 1-phase induction motor in a point of view of design.`	**07**