Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2170909 **Date:27/05/2019**

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)**	Define 'Specific electric loading' and 'Specific magnetic loading' in connection with 3-phase induction motor.	**03**
	(b)	Derive an output equation for 3-ϕ induction motor with usual notation.	**04**
	(c)	Define SCR. Discuss its effects on synchronous machine performance.	**07**
Q.2	**(a)**	State the rules for the selection of rotor slots in 3-phase squirrel cage induction motor.	**03**
	(b)	Explain Harmonic torque in 3-ϕ induction motor.	**04**
	(c)	Determine 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/m^2, 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)	A 15 kW, 400 V, 3 phase, 50 Hz, 6 pole induction motor has a diameter of 0.3 m and the length of core 0.12 m. The number of stator slot is 72 with 20 conductors per slot. The stator is delta connected. Calculate the value of magnetizing current per phase if the length of air gap is 0.55 m. The gap contraction factor is 1.2. Assume the mmf required for the iron parts to be 35 per cent of the air gap mmf. Coil span = 11 slots.	**07**
Q.3	**(a)**	What is the role of damper winding in (i) synchronous generator and (ii) synchronous motor?	**03**
	(b)	Explain the factors affecting the choice of specific Magnetic loading in case of a Synchronous machine.	**04**
	(c)	Find the main dimensions of a 2500 kVA, 187.5 r.p.m., 50 Hz, 3-phase, 3 kV, salient pole synchronous generator. The generator is to be a vertical, water wheel type. The specific magnetic loading is 0.6 Wb/m^2, and the specific electric loading is 34000A/m. use circular poles with ratio of core length to pole pitch = 0.65. specify the type of pole construction used if the run-away speed is about 2 times the normal speed.	**07**
		OR	
Q.3	**(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) The following is the design data available for a 1250 kVA, 3-phase, 50 Hz, 3300 V, star connected, 300 r.p.m. alternator of salient pole type: **07**

Stator bore D = 1.9 m, stator core length L = 0.335 m, turns per phase =150, pole arc/pole pitch = 0.66, single layer concentric winding with 5 conductors per slot, short circuit ratio=1.2. assume that the distribution of gap flux is rectangular under the pole arc with zero values in the interpolar region. Calculate:

(a) Specific magnetic loading (c) armature mmf/ pole
(b) Gap density over pole arc (d) air gap length.

Mmf required for air gap is 0.88 of no load field mmf and the gap contraction factor is 1.15.

Q.4 **(a)** List out factors affecting determining air gap length in induction motor design & Explain any one. **03**

(b) Explain main differences between design of 1-phase and 3-phase induction motor. **04**

(c) Write a brief note on stator design of 1-phase induction motor **07**

OR

Q.4 **(a)** List out the factors to be considered while selecting number of armature slots in the design of a synchronous machine & explain any one. **03**

(b) Calculate the value of capacitance for maximum starting torque in 1-phase induction motor. **04**

(c) Write a brief note on rotor design of 1-phase induction motor. **07**

Q.5 **(a)** Explain direct axis and quadrature axis synchronous reactance in synchronous machine. **03**

(b) What is dispersion coefficient? What is its effect on maximum power factor? **04**

(c) Explain significance of FEM in design problem. **07**

OR

Q.5 **(a)** State why a turbo alternator has smaller diameter and large length but hydro alternator has larger diameter and small length? **03**

(b) Write a note on computer aided design of Induction motor. **04**

(c) Discuss application of FEM technique for design problems. **07**

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