

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2170909

Date: 29/11/2018

Subject Name: Design of AC Machines

Time: 10:30 AM TO 01:30 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 direct axis and quadrature axis synchronous reactance in synchronous machine.	03
	(b) State important design difference between turbo alternators and hydro generators.	04
	(c) What do you mean by specific electric loading and specific magnetic loading applied to electric machines? State the factors on which the choice of these loadings depends.	07
Q.2	(a) Explain harmonic induction and harmonic synchronous torques produced in induction motor.	03
	(b) Explain the terms “critical speed” and “run away speed” with reference to synchronous machine.	04
	(c) Explain the term SCR and its effects on synchronous machine performance	07
	OR	
	(c) Explain steps for design of field winding of synchronous machine.	07
Q.3	(a) What are the design criteria that should be taken care while design of submersible motors?	03
	(b) Explain which combinations of number of stator and rotor slots should be avoided in the induction motor design ? why?	04
	(c) Write a note on computer aided design of Induction motor. Explain algorithm steps to find main dimensions.	07
	OR	
Q.3	(a) What is done to reduce tooth pulsation losses in an induction motor?	03
	(b) Discuss the Finite Element Method for design of electrical machine	04
	(c) State the rules for the selection of rotor slots. Describe the methods for reducing the effect of harmonics torque.	07
Q.4	(a) Explain estimation of full load field mmf in synchronous machine.	03
	(b) Draw and explain briefly the current distribution wave form speeded over one pole pitch in bars and end rings squirrel cage induction motor	04
	(c) Estimate the main dimensions, air gap length, no of stator slots, stator turns per phase and cross sectional area of stator conductors for a 3 phase, 20 h.p., 400V, 6 poles, 50 Hz, 970 rpm, induction motor, suitable for a star delta starting. Assume magnetic and electric specific loadings as 0.45 wb/m ² , and 23000 ac/m respectively, current density = 4 A/mm ² , ratio of core length to pole pitch is 0.85, full load efficiency 0.88 and power factor 0.89.	07

OR

- Q.4** (a) Why closed types slots are often used for small induction motors? **03**
(b) In single phase induction explain design of auxiliary winding for capacitor start motor. **04**
(c) What is Dispersion coefficient? Explain the effect of Dispersion coefficient on maximum output power factor. **07**
- Q.5** (a) Explain how length of air gap is estimated in synchronous machine. **03**
(b) Explain how mmf is calculated for magnetic circuit in synchronous machine. **04**
(c) Determine the main dimensions of a 12 MVA, 13.8KV, 50Hz, 1500 rpm, 3 star connected synchronous generator. The additional data is given as: $B_{av} = 0.6 \text{ wb/m}^2$, $a_c = 42000 \text{ ac/m}$ and peripheral speed = 80m/sec. Find also the maximum flux, the number of stator slots if one conductor per slot is used, and the number of turns per phase. **07**

OR

- Q.5** (a) Discuss the effect of “skewing” on the performance of three phase induction motor. **03**
(b) Explain design considerations to eliminate harmonics in synchronous machines.. **04**
(c) Briefly discuss factors affecting determining air gap length in induction motor design. **07**

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