Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VIII.EXAMINATION – WINTER 2016

Subject Code: 180904 Date: 25/10/2016

Subject Name: Electrical Machine Design II

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.**

Q.1 **(a)** Answer in brief. **06**

I. Why does an induction motor designed with higher specific electric loading have smaller over load capacity?

II. What is done to reduce tooth pulsation losses in an induction motor?

III. What is crawling?

IV. What types of slots give quiet operation of induction motor?

V. Why turbo-generators are designed for smaller diameter and larger axial length where as water wheel generators have just the opposite?

VI. What is the function of damper winding in case of synchronous motor and in case of synchronous generator?

(b) State the advantages and disadvantages of larger air-gap length in case of synchronous machines. **08**

Q.2 **(a)** Define SCR and its importance in designing of synchronous machine. **07**

(b) Design the stator frame of a 500 KVA, 6.6 KV, 50 Hz, 3-phase, 12 pole, star connected salient pole alternator, giving the following information. **07**

1. Internal diameter and gross length of stator.
2. Number of slots and conductor per slot.
3. Number of stator conductors.

Assume specific magnetic and electric loading as 0.56T and 26000 AC per metre respectively. Peripheral speed must be less than 40 m/s and slot must be less than 120.

OR

(b) Find the main dimensions of a 100 MVA, 11 KV, 50 Hz, 150 rpm, 3-phase water wheel generator. The average gap density is 0.65T and Ampere conductor per metre 40000. The peripheral speed should not exceed 65 m/s at normal running speed to limit run away speed. **07**

Q.3 **(a)** Explain different methods use to eliminate harmonics from the voltage waveform in synchronous generator. **07**

(b) State and explain the factors to be consider in selection of stator slots in case of synchronous generator. **07**

OR

Q.3 **(a)** Show that the output for a 1 phase induction motor is $2/3^{rd}$ of that for a 3-phase equivalent induction motor for the same D^2L value. **07**

(b) Discuss the steps for rotor design of a 1-phase induction motor. **07**

Q.4 **(a)** Give the rules for selecting number of rotor slots in induction motor. **07**

(b) State and discuss the factors to be considered why determining the air-gap length in case of 3-phase induction motor. **07**

OR

Q.4 **(a)** What is dispersion Co-efficient? What is its effect on (1) Power factor (2) overload capacity of induction motor? **07**

(b) Determine the main dimension, turns/phase, conductors, cross sectional area and slot area of a 250 HP, 3- phase. 50 Hz, 400 Volt 1410 rpm Slip ring induction motor. Assume average flux density = 0.5T, AC/m = 30000 efficiency =0.9, PF = 0.9 winding factor 0.955 and current density = 3.5 A/mm^2. The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. The machine is delta connected. **07**

Q.5 **(a)** Derive the equation of capacitance to give maximum starting torque of capacitor start 1-phase induction motor. **07**

(b) Compare design difference between 3-phase induction motor and 1-phase induction motor. **07**

OR

Q.5 **(a)** A 15 KW , 400 Volt 3-phase , 50 Hz , 6 pole induction motor has a diameter 0f 0.3 metre and core length 0.12 metre .the no of stator slots = 72 with 20 conductors per slot. The stator is delta connected. Calculate the value of magnetizing current per phase if the length of the air-gap is 0.55 mm. The gap contraction factor is 1.2. Assume the MMF required for the iron parts to be 30% of the air-gap MMF. Coil span = 11 slots. **07**

(b) Develop a flow chart an discuss algorithm for main dimension for 3-Phase induction motor **07**

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