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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (OLD) - EXAMINATION – SUMMER 2017

Subject Code:180904 **Date:09/05/2017**

Subject Name: Electrical Machine Design II

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.**

Q.1	**(a)**	In the design of 3- phase induction motor, how to select average flux density in air gap as well as ampere conductors per meter.	**07**
	(b)	Determine the main dimensions, no of radial ventilating ducts, no of stator slots and no of turns per phase of a 3.7 kW, 400 volts, 3 phase, 4 pole, 50 Hz Squirrel cage induction motor to be started by a star delta starter. Assume: Average flux density in air gap = 0.45 wb/m^2, ampere conductors per meter=23000, efficiency=0.85 and power factor=0.84	**07**
Q.2	**(a)**	In synchronous machine design, how to choose specific magnetic loading.	**07**
	(b)	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 34000 A/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	
	(b)	Explain design procedure for stator of single phase induction motor.	**07**
Q.3	**(a)**	Write a short note on Short Circuit Ratio of synchronous machine. Also discuss in detail the significance of SCR in synchronous machine design.	**07**
	(b)	Find the main dimensions of a 15kW, 3 phase, 400V, 50Hz, 2810 r.p.m. squirrel cage induction motor having 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. Take rotor peripheral speed as approximately 20m/s at synchronous speed.	**07**
		OR	
Q.3	**(a)**	Derive an expression for relationship between rating and size of the machine in three phase induction motor.	**07**
	(b)	Determine the main dimensions for a 1000 kVA, 50 Hz, 3 phase 375 rpm alternator. The average air gap flux density is 0.55 Wb$/m^2$ and ampere conductors per meter are 28000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which maximum permissible peripheral speed is 50 m/s. The runaway speed is 1.8 times the synchronous speed.	**07**
Q.4	**(a)**	Explain factors affecting specific electric loading of alternator.	**07**
	(b)	A 3 phase, 1440 rpm, 50 Hz, 415 V, 22 kW, star connected squirrel cage induction motor has 48 stator slots with 20 conductors/ slot. Calculate the bar and end ring current if the rotor has 55 slots. The full load efficiency is 0.88 and full load power factor is 0.89 Also find the cross section of the bar and end ring. If the current density is 6A/mm^2, assume that the rotor ampere turns is 0.85 times the stator ampere turns.	**07**

OR

Q.4	**(a)**	Explain the effect of Harmonic induction torque and Harmonic synchronous torque on the performance of 3 phase induction motor.	**07**
	(b)	Determine a suitable no of slots and conductors per slot for the stator winding of a 3 phase 3300 volts, 50 Hz, 300 rpm alternator. The diameter is 2.3 m and the axial length of core is 0.35 m. The maximum flux density in the air gap should be approximately 0.9 Wb/m^2 . Assume sinusoidal flux distribution. Use single layer winding and star connection for stator.	**07**
Q.5	**(a)**	Discuss the effect of air gap length on performance of synchronous machine.	**07**
	(b)	Explain the steps for field winding design in case of synchronous machine.	**07**

OR

Q.5	**(a)**	Explain methods of improving starting torque of induction motor.	**07**
	(b)	Discuss the effects for rotor design of a single phase induction motor.	**07**

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