Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Electrical Machine Design - II

Subject Code: 4TE08EMD1 **Branch: B.Tech (Electrical)**

Semester: 8 **Date: 12/04/2017** **Time: 02:30 To 05:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) In induction motors, the difference between the number of stator and rotor slots should not be **(1)**

(A) P (B) 2P
(C) 5P (D) any of the above

b) Which kind of rotor is most suitable for turbo alternators which are designed to run at high speed? **(1)**

(A) salient pole type (B) non-salient pole type
(C) both (A) and (B) (D) none of the above

c) The maximum speed variation in a 3-phase synchronous motor is **(1)**

(A)10% (B) 6%
(C) 4% (D) 0%

d) Short circuit ratio for turbo-alternators is usually **(1)**

(A)0.1 to 0.2 (B) 0.2 to 0.4
(C) 0.5 to 0.7 (D) 0.8 to 0.95

e) In a synchronous generator in order to eliminate the fifth harmonic the chording angle should be **(1)**

(A) 9° (B) 18°
(C) 36° (D) 72°

f) The shaft of an induction motor is made up of **(1)**

(A)high speed steel (B) stainless steel
(C) carbon steel (D) cast iron

g) In synchronous motor the torque is proportional to **(1)**

(A)Power P (B) 1/P
(C) P^2 (D) $1/P^2$

h) In a capacitor start motor, the phase displacement between starting and running winding can be nearly **(1)**

(A) 90° (B) 0°
(C) 30° (D) 60°

i) The efficiency of a 3-phase induction motor is approximately proportional to **(1)**

(A)s (B) 1-s

(C) N_s (D) N

j) The ratio of core length to pole pitch for good efficiency is **(1)**

(A) 0 (B) 0.5

(C) 1.5 (D) 1

k) The value of slip at full load is determined by the **(1)**

(A) rotor resistance (B) stator resistance

(C) slip (D) none of the above

l) The power factor of a single-phase induction motor is usually **(1)**

(A) unity (B) lagging

(C) always leading (D) unity to 0.8 leading

m) Define the term : total magnetic loading **(1)**

n) Define the term : specific electrical loading **(1)**

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(a) Derive the output equation for ac machine. **(7)**

(b) Explain methods for improving starting torque in three phase induction motor. **(7)**

Q-3 **Attempt all questions** **(14)**

(a) Explain elimination of harmonics in synchronous machines. **(7)**

(b) Explain different approaches for computer aided design. **(7)**

Q-4 **Attempt all questions** **(14)**

(a) What is Short circuit ratio? Explain effect of SCR on synchronous machine performance. **(7)**

(b) A 90 kW, 500 v, 50 Hz, 3 phase, 8 pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors per slot. If the slip ring voltage on open circuit is to be about 400 V, find a suitable rotor winding, stating: **(7)**

(a) Number of slots (b) number of conductors per slot (c) coil span (d) slip ring voltage on open circuit (e) approximate full load current per phase in rotor. Assume efficiency = 0.9; power factor = 0.86.

Q-5 **Attempt all questions** **(14)**

(a) Explain design of rotor bars and slots of three phase induction motor. **(7)**

(b) An 11 kW, 3 phase, 6 pole, 50 Hz, 220 V, star connected induction motor has 54 stator slots, each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine has an efficiency of 0.86 and a power factor of 0.85. The rotor mmf may be assumed as 85 percent of stator mm. **(7)**

Also find the bar and the end ring sections if the current density is $5A/mm^2$.

Q-6 **Attempt all questions** **(14)**

(a) What is computer aided design? Explain advantages and limitation of computer **(7)**

aided design of machines.

	(b)	Explain design of damper winding.	**(7)**
Q-7		**Attempt all questions**	**(14)**
	(a)	State some methods to reduce the harmonic torque in induction motors.	**(7)**
	(b)	Which factors should be considered when estimating the length of the air-gap of the induction motor? Why the air-gap should be as small as possible?	**(7)**
Q-8		**Attempt all questions**	**(14)**
	(a)	Find the main dimensions of a 100 MVA, 11 kV, 50 Hz, 150 r.p.m., 3 phase water wheel generator. The average gap density is 0.65 Wb/m^2 and ampere conductors per meter are 40,000. The peripheral speed should not exceed 65 m/s at normal running speed in order to limit the run-away peripheral speed.	**(7)**
	(b)	Explain design of starting winding for split phase motors.	**(7)**