Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Electrical Machine Design - II

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

Semester: 8 **Date: 24/04/2018** **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) Basically induction machine was invented by **(1)**
(A) Thomas Alva Edison (B) Fleming
(C) Nikola Tesla (D) Michel Faraday

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 frame of an induction motor generally made up of **(1)**
(A) silicon steel (B) aluminium
(C) bronze (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 minimum value of number of slots per pole per phase (q) is **(1)**

(A) 0 (B) 1

(C) 4 (D) 2

l) A three phase 440 V, 50 Hz induction motor has 4% slip. The frequency of rotor emf will be **(1)**

(A) 200 Hz (B) 50 Hz

(C) 2 Hz (D) 0.2 Hz

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

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

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

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

(a) State some methods to reduce the harmonic torque in induction motor. **(7)**

(b) Explain different approaches for Computer Aided Design. **(7)**

Q-3 **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-4 **Attempt all questions** **(14)**

(a) How do you calculate the following for an induction motor? **(7)**

(i) area of stator slots

(ii) length of mean turn

(iii) stator teeth

(b) Find 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: **(7)**

Specific magnetic loading = 0.5 Wb/m^2 ; specific electric loading = 25000 A/m. Take the rotor peripheral speed as approximately 20 m/s at synchronous speed.

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

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

(b) A 3 phase, 2 pole, 50 Hz squirrel cage induction motor has a rotor diameter 0.20 m and core length 0.12 m. The peak density in the air gap is 0.55 Wb/m^2. The rotor has 33 bars, each of resistance 125 μΩ and a leakage inductance 2 μH. The slip is 6%. Calculate (i) the peak value of current in each bar (ii) rotor I^2R loss (iii) rotor output and (iv) torque exerted. Neglect the resistance of end rings. **(7)**

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

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

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

Q-7 **Attempt all questions** **(14)**

(a) Explain design of damper winding. **(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 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. **(7)**

(b) Explain design of starting winding for capacitor start motors. **(7)**