Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY
Winter Examination-2018

Subject Name: Electrical Machine Design-I

Subject Code: 4TE07EMD1 **Branch:** B.Tech (Electrical)

Semester: 7 **Date: 29/11/2018** **Time: 10:30 To 01:30** **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) Define the term : Window space factor **(01)**

b) Define the term : total magnetic loading **(01)**

c) Define the term : total electrical loading **(01)**

d) Tap changing facility is generally provided on **(01)**
(A) high voltage transformers
(B) distribution transformers
(C) current transformers
(D) Step up transformers.

e) Helical windings are used in **(01)**
(A) distribution transformers (B) power transformers
(C) shell type transformers (D) none of above

f) Lap winding is suitable for……. current, …… voltage d.c. generators. **(01)**
(A) high, low (B) low, high (C) low, low (D) high, high

g) The basic requirement of a d.c. armature winding is that it must be **(01)**
(A) a closed one (B) a lap winding (C) a wave winding (D) either B or C

h) The maximum efficiency of a distribution transformer is **(01)**
(A) at no load (B) at 50% of Full load
(C) at 80% of full load (D) at full load

i) In a transformer the resistance between its primary and secondary is **(01)**
(A) zero (B) 1 ohm (C) 1000 ohm (D) infinite

j) In D.C. machines the usual limit of slot pitch is **(01)**
(A) between 5 to 10 mm (B) between 10 to 15 mm
(C) between 15 to 20 mm (D) between 25 to 35 mm

k) For a simplex lap winding, the commutator pitch is equal to **(01)**
(A) +1 (B) +1 or -1 (C) -1 (D) +2 or -2

l) The permissible flux density in case of cold rolled grain oriented steel is around **(01)**
(A) 1.7 Wb/m^2 (B) 2.7 Wb/m^2 (C) 3.7 Wb/m^2 (D) 4.7 Wb/m^2

m) Losses in a machine increases as the _____ of the linear dimensions of the machine. **(01)**
(A) inverse (B) inverse square

(C) cube (D) square

n) What are the main factor which governs the size and rating of an electric machine? **(01)**

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

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

(a) Derive the output equation of single phase transformer. **(07)**

(b) Calculate approximate overall dimensions for 200 kVA, 6600/400 V, 50 Hz, 3-phase core type transformer. The following data may be assumed: **(07)**
Emf per turn = 10V, Maximum flux density = 1.3 Wb/m^2, current density = 2.5 A/mm^2, window space factor = 0.3, overall height = overall width, stacking factor = 0.9, use a 3 stepped core.
For a three stepped core:
Width of largest stamping = 0.9d and Ai = 0.6 d^2, where d is diameter of circumscribing circle.

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

(a) What are the factors which limit the design of an electrical machine? **(07)**

(b) Derive the condition for the optimum design of transformer for the minimum cost and minimum losses. **(07)**

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

(a) A single phase, 400 V, 50 Hz, transformer is built from stampings having a relative permeability of 1000. The length of the flux path is 2.5 m, the area of cross section of the core is 2.5 x 10^{-3} m^2 and the primary winding has 800 turns. Estimate the maximum flux and the load current of the transformer. The iron loss at the working flux density is 2.6 W/kg. Iron weighs 5.8 x 10^3 kg/m^3. Stacking factor is 0.9. **(07)**

(b) Explain conducting and magnetic materials. **(07)**

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

(a) What are the types of windings commonly used in transformer and on what basis are they selected? **(07)**

(b) A design is required for a 50 kW, 4 pole, 600 r.p.m. d.c. shunt generator, the full load terminal voltage being 220 V. If the maximum gap density is 0.83 Wb/m^2 and the armature ampere conductors per metre are 30,000, calculate suitable dimensions of armature core to give a square pole face. **(07)**

Assume that the full load armature voltage drop is 3 per cent of the rated terminal voltage, and that the field current is 1 percent of rated full load current. Ratio of pole arc to pole pitch is 0.67.

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

(a) Define specific electrical and magnetic loading and derive the output equation of DC machines. **(07)**

(b) Discuss the factors that influence the choice of number of poles of a d.c.machine. **(07)**

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

(a) What are the factors that affect the size of rotating machines? **(07)**

(b) Explain the design of Interpoles of DC machine. **(07)**

Q-8 **Attempt all questions** **(14)**

(a) Define the term: **(07)**
(a) front pitch (b) back pitch (c) commutator pitch (d) dummy coil (e) equilizer connection (f) average pitch (g) pole pitch

(b) Explain the design procedure in the design of field windings for a d.c. shunt machine. **(07)**