Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2019

Subject Name : Electrical Machine Design – I
Subject Code : 4TE07EMD1 **Branch:** B.Tech (Electrical)
Semester : 7 Date : 13/03/2019 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 : total electrical loading
b) Define the term : specific magnetic loading
c) Define the term : Window space factor
d) The permissible flux density in case of cold rolled grain oriented steel is around
(A) 1.7 Wb/m^2 (B) 2.7 Wb/m^2 (C) 3.7 Wb/m^2 (D) 4.7 Wb/m^2
e) For a simplex lap winding, the commutator pitch is equal to
(A) +1 (B) +1 or -1 (C) -1 (D) +2 or -2
f) The basic requirement of a d.c. armature winding is that it must be
(A) a closed one (B) a lap winding
(C) a wave winding (D) either B or C
g) The maximum efficiency of a distribution transformer is
(A) at no load (B) at 50% of Full load
(C) at 80% of full load (D) at full load
h) Helical windings are used in
(A) distribution transformers (B) power transformers
(C) shell type transformers (D) none of above
i) In a transformer the resistance between its primary and secondary is
(A) zero (B) 1 ohm (C) 1000 ohm (D) infinite
j) In D.C. machines the usual limit of slot pitch is
(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) Losses in a machine increases as the _____ of the linear dimensions of the machine.
(A) inverse (B) inverse square
(C) cube (D) square
l) Define : Insulating materials
m) Draw: Helical winding
n) What are the main factors which govern the size and rating of an electric machine?

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

Q-2 Attempt all questions (14)

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

	(b)	Calculate approximate overall dimensions for a 200 KVA, 6600/440V, 50Hz, 3-phase core type transformer. The following data may be assumed: e.m.f per turn=10 V; 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 three stepped core. Width of largest stampings=0.9d, and Net iron area=$0.6d^2$ where d is the diameter of circumscribing circle.	**(07)**
Q-3		**Attempt all questions**	**(14)**
	(a)	Derive the condition for the optimum design of transformer for the minimum cost and minimum losses.	**(07)**
	(b)	Explain conducting and magnetic materials.	**(07)**
Q-4		**Attempt all questions**	**(14)**
	(a)	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. 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.	**(07)**
	(b)	Derive the output equation of single phase transformer.	**(07)**
Q-5		**Attempt all questions**	**(14)**
	(a)	Explain the design procedure in the design of field windings for a d.c. shunt machine.	**(07)**
	(b)	What are the factors that affect the size of rotating machines?	**(07)**
Q-6		**Attempt all questions**	**(14)**
	(a)	Explain the design of Interpoles of DC machine.	**(07)**
	(b)	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 2.5×10^{-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 5.8×10^3 kg/m^3. Stacking factor is 0.9.	**(07)**
Q-7		**Attempt all questions**	**(14)**
	(a)	What are the types of windings commonly used in transformer and on what basis they are selected?	**(07)**
	(b)	Explain various factors affecting selection of numbers of armature slots for D.C. machine.	**(07)**
Q-8		**Attempt all questions**	**(14)**
	(a)	Define specific electric loading and magnetic loading and derive the output equation of d.c.machine.	**(07)**
	(b)	Explain different methods of cooling of transformers.	**(07)**