Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE409

Course Name: ELECTRICAL MACHINE DESIGN

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1		List five types of enclosures used in electrical machines.	(5)
2		Derive the output equation of a single phase core type transformer.	(5)
3		Define specific magnetic loading? Explain the factors need to be considered for choice of specific magnetic loading in a dc machine	(5)
4		Write short notes on (i) Short circuit ratio (ii) Run away speed.	(5)
5		How do you separate 'D' and 'L' from the volume D^2L of a 3 phase induction motor?	(5)
6		Explain the rules for selecting number of rotor slots in a three phase induction motor.	(5)
7		What is meant by discretization in finite element method?	(5)
8		Explain the hybrid techniques available for computer aided design.	(5)

PART B

Answer any two full questions, each carries 10 marks.

9	a)	Examine the different types of ventilations in electrical machines.	(4)
	b)	Derive the gap contraction factor for slots.	(6)
10		Determine the dimensions of core and yoke for a 100KVA 50Hz single phase core type transformer. A square core is used with distance between the adjacent limbs equal to 1.6 times the width of laminations. Assume Emf/turn 14V, Maximum flux density 1.1 Wb/m^2, current density 3 A/mm^2, window space factor 0.32, stacking factor 0.9. Flux density in the yoke to be 80% of flux density in the core.	(10)
11	a)	Explain the procedure to calculate MMF for air gap and teeth in an electrical machine.	(5)
	b)	Derive the volt per turn equation of a single phase transformer.	(5)

PART C

Answer any two full questions, each carries 10 marks.

12	a)	Explain in steps how to separate D and L for a DC machine?	(3)
	b)	Find out the main dimensions of a 50kW, 4 pole, 600 rpm DC shunt generator to give a square pole face. The full load terminal voltage being 220 V. The maximum gap density is 0.83 Wb/m^2 and the ampere conductors per meter is 30000. Assume that full load armature voltage drop is 3 per cent of rated terminal voltage and that the field current is 1 per cent of rated full load	(7)

current. Ratio of pole arc to pole pitch is 0.67.

13 a) Distinguish between cylindrical pole and salient pole construction. (3)

b) Determine the main dimensions of a 2500 kVA 187.5 rpm, 50Hz 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/mm^2 and the specific electric loading is 34000A/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)

14 a) Explain the design procedure of interpoles in DC machines? (5)

b) Determine the main dimensions of a 500 kVA, 50Hz 3 phase alternator to run at 375 rpm. The average air gap flux density is 0.55wb/mm^2, the specific electric loading is 25000A/m. The peripheral speed should not exceed 35m/sec. (5)

PART D

Answer any two full questions, each carries 10 marks.

15 (a) With all details of the various parameters including the units derive the output equation of a 3 phase squirrel cage induction motor. (5)

(b) Design the main dimensions of a 25 kW, 3 phase, 415V, 50 Hz, 1475 rpm squirrel cage induction motor having an efficiency of 85 % and full load power factor of 0.86. Assume B_{av} = 0.5T, ac = 28000A/m. The rotor peripheral velocity is 25 m/s at synchronous speed. (5)

16 a) Explain how finite element method is used for analysis of electrical machines. (6)

b) List out the advantages of FEM based methods over conventional design procedures. (4)

17 a) Explain the procedure for separation of D and L from D^2L product while designing induction motors. (5)

b) What is computer aided design? How does it help in designing electrical machines? (5)

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