Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh semester B.Tech examinations (S), September 2020

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	Establish a relation between apparent flux density and real flux density for the armature teeth of a DC machine.	(5)
2	What are the advantages of square core over rectangular core of a transformer?	(5)
3	Explain why a stationary armature and revolving field type of construction is most convenient for a synchronous generator.	(5)
4	What are the important points to be considered while selecting the type of winding in dc machine?	(5)
5	What are the guiding factors that decide the selection of ampere conductors per metre of an induction machine?	(5)
6	Derive output equation of induction machine.	(5)
7	What are the salient points of analysis methods of design of machine? Draw the flow chart corresponding to analysis method.	(5)
8	What are the hybrid techniques available for computer aided design?	(5)

PART B

Answer any two full questions, each carries 10 marks.

9	a)	What do you understand by continuous, short time and short time intermittent ratings of an electrical machine?	(5)
	b)	What is carter's coefficient and how does it help in estimation of mmf of slotted armature?	(5)
10	a)	What are the practical aspects of unbalanced magnetic pull that must be considered while designing electrical machines?	(5)
	b)	Derive the output equation of a three-phase transformer.	(5)
11		Calculate the approximate overall dimensions for a 200 kVA, 6600/440 V, 50 Hz, 3 phase core type transformer. The following data may be assumed: emf per turn = 10 V, maximum flux density = 1.3 Wb/m2, current density = 2.5 A/mm2, window space factor = 0.3, overall height = overall width, stacking factor = 0.9. Use a 3 stepped core. For a 3 stepped core: Width of largest stamping = 0.9d and net iron area = $0.6d^2$ where d is the diameter of the circumscribing circle.	(10)

PART C

Answer any two full questions, each carries 10 marks.

12 a) What is meant by specific electric and specific magnetic loading in a dc machine? From first principles, obtain the expressions for specific magnetic loading and specific electric loading. (5)

b) A 350KW, 500V, 450 rpm, 6 pole dc generator is to built with an armature diameter of 0.87m and core length of 0.32 m. The lap wound armature has 660 conductors. Calculate the specific electric and specific magnetic loadings. (5)

13 A 500KW, 460V, 8 pole, 375 rpm compound generator has an armature diameter of 1.1m and core length of 0.33m. Design a symmetrical armature winding. The armature ampere conductors/metre are 34000.The internal voltage drop is 4% of terminal voltage and field current is 1% of output current. The ratio of pole arc to pole pitch is 0.7.The voltage between adjacent segments at no load should not exceed 15V and the slot loading should not exceed 1500 amps. The diameter of the commutator is 0.65 of armature diameter and minimum allowable pitch of segment is 4mm. Make suitable assumptions. (10)

14 a) Derive the output equation of a synchronous generator (4)

b) Find the main dimensions of a 2500 KVA, 187.5 rpm,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 0.6Wb/m^2. The specific electric loading is 34000 Amp/m. Use circular poles with ratio of core length to pole pitch is 0.65. Specify the type of pole construction used. The runaway speed is about 2 times the normal speed. (6)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Explain the procedure for design of rotor bars and slots in a squirrel cage induction motor. (5)

b) Describe the salient features of computer aided design of electrical machines. What are the advantages of computer aided design? (5)

16 a) Derive an expression for the end ring current of a squirrel cage induction motor. (5)

b) Explain how FEM is used for the analysis of electrical machines. (5)

17 A 15KW, 440V, 4 poles, 50Hz, 3 Phase induction motor is built with a stator bore 0.25m and core length of 0.16m. The specific loading is 23000Amp conductors/m. Using the data of this machine; determine the core dimensions, no. of stator slots and number of stator conductors for a 11 KW, 460V, 6 pole, 50Hz motor. Assume a full load efficiency of 84% and power factor of 0.82 for each machine. The winding factor is 0.955. (10)

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