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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Regular and Supplementary Examination December 2021 (2015 Scheme)

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		What are the practical aspects of unbalanced magnetic pull?	(5)
2		Derive the output equation of a single phase transformer.	(5)
3		Explain the types of specific loadings used for the design of DC machines.	(5)
4		The output coefficient of 1250kVA,300 rpm, synchronous generator is 200.The ratio of length to the diameter is 0.2.Calculate the main dimensions if the specific loadings are decreased by 20 % with speed remaining constant.	(5)
5		Distinguish between slip ring and squirrel cage induction motor	(5)
6		What are the guiding factors used for the selection of number of stator slots in 3 phase induction motors?	(5)
7		Explain the historical background of finite element method?	(5)
8		With the help of a flow chart, explain the analysis method of design of CAD	(5)

PART B

Answer any two full questions, each carries 10 marks.

9		Explain any 5 types of enclosures used in electrical machines.	(10)
10	a)	A DC motor has final temperature rise of 80 °C and a heating time constant of 75 minutes. Estimate at this load, the temperature rise after 1 hour	(5)
	b)	Explain the different types of cooling methods used for dry type transformers.	(5)
11	a)	The ratio of full load mmf in a 400kVA,50 hz ,single phase core type transformer is 2.4×10^{-6}.Calculate the net iron area and full load mmf of the transformer. Maximum flux density in the core is 1.3 wb/m^2,current density is 2.7 A/mm^2 and the window space factor =0.26.	(5)
	b)	Differentiate between power transformer and distribution transformer	(5)

PART C

Answer any two full questions, each carries 10 marks.

12 a) How can the main dimensions D and L can be separated for a DC machine? (5)

b) Differentiate hydro generators and turboalternators (5)

13 A design is required for a 50kW,4 pole ,600 rpm DC 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 meter are 30000.Calculate the pole dimensions of the armature.The armature core is of square pole face.Assume that full load armature voltage drop is 3% of the rated terminal voltage and field current is 1% of rated full load current. Take ratio of pole arc to pole pitch to be 0.67 (10)

14 A 600 MVA, 22000V, 50hz, 2 pole , 3 phase star connected direct water cooled generator has a stator bore of 1.3 m and stator core length of 6m.The specific electric loading is 200000 A/m and winding factor is 0.955.If the stator winding has 2 conductors per slot and there are 2 circuits per phase, calculate (10)

(i) Number of turns

(ii) Number of slots

(ii) Average flux density in the air gap

PART D

Answer any two full questions, each carries 10 marks.

15 a) Explain the design of rotor bars in three phase induction motors (5)

b) A 11kV, three phase, 6 pole, 50Hz, 220 V, star connected induction motor has 54 stator slots each containing 9 conductors. Calculate the value of rotor bar current and area of rotor bars. The number of rotor bars is 64. The machine has an efficiency of 0.86 and power factor of 0.85. Rotor mmf may be assumed as 85% of stator mmf. Assume a current density of 5 A/mm^2 (5)

16 a) A three phase, 2 pole, 50 Hz, squirrel cage induction motor has a rotor diameter of 20 cm and core length of 12 cm.The peak density in the air gap is 0.55 wb/m^2.The rotor has 33 bars ,each of resistance $125\mu\Omega$ and inductance of $2\mu H$.The slip is 6%.Calculate the peak value of current in each bars. (5)

b) Explain the different types of CAD software used (5)

17 Write short notes on (i) Advantages of FEM (ii) New computer aided machine software using Finite Element (iii) Hybrid method (iv) Applications of FEM (10)

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