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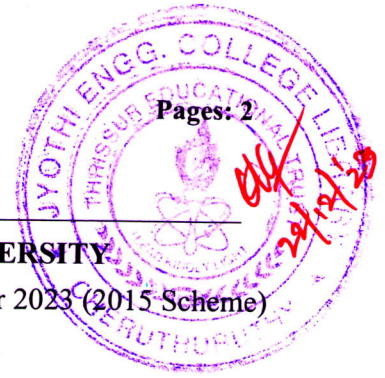
Pages: 2

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (S, FE) / S7 (PT) (S, FE) Examination December 2023 (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 Enumerate the different types of enclosures used in electrical machines. (5)
- 2 Derive the EMF per turn equation of Transformer in terms of kVA rating. (5)
- 3 What are the factors to be considered for the choice of specific magnetic loading in dc machines? (5)
- 4 What is runaway speed? (5)
- 5 Why the air gap of an induction motor is made as small as possible? (5)
- 6 What are the rules to be followed for selection of rotor slots in squirrel cage Induction machines? (5)
- 7 What is computer aided design? (5)
- 8 Explain any one software used for designing electrical machines? (5)

PART B

Answer any two full questions, each carries 10 marks.

- 9 a) Derive the relation between real and apparent flux densities? (5)
b) Derive the output equation of single-phase core transformer? (5)
- 10 Determine the dimensions of the core, number of turns, cross section area of conductors in the primary and secondary windings of a 100 kVA, 2200/400V, 50Hz single phase core type transformer. Assuming volt/turn = 7.2V, maximum flux density = 1.02 Wb/m^2 . Ratio of effective cross sectional area of core to square of diameter of circumscribing circle is 0.6. Ratio of height to width of window is 2. Window space factor is 0.27. Current density = 2.5 A/mm^2 . (10)
- 11 a) A 450kW, 500V, 500 rpm 6 pole DC generator is build with an armature diameter of 0.9m and core length of 0.3m. The lap wound armature has 600 conductors. Calculate the specific electric and magnetic loading. (5)
b) What is meant by hot spot rating of electrical machines? (5)

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) Derive the output equation of DC machine. (5)
b) Find the main dimensions of 4 kW, 240V, 6 pole, 900 rpm dc generator. The maximum flux density in the gap is 0.8 Wb/m^2 and the ampere conductors per metre of armature periphery are 16000. The ratio of pole arc to pole pitch is 0.6 and the efficiency is 90%. Assume the ratio of length of core to pole pitch is 0.7. (5)
- 13 Determine the main dimensions of 1000 kVA, 500 rpm, 50 Hz three phase alternator. The average air gap flux density is 0.5 Wb/m^2 and the ampere conductors per metre is 30000. Assume the ratio of length of core to pole pitch is 2. The maximum permissible peripheral speed is 50m/sec. (10)
- 14 a) What are the factors to be considered for the choice of specific electric loading in synchronous machines? (5)
b) What are the advantages and disadvantages of higher number of poles in dc machine? (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) List out the methods to improve the power factor of induction motor. (5)
b) How the finite element method is used for analysis of electrical machines? (5)
- 16 Determine the diameter and length of stator core, number of stator slots and number of stator conductors for a 10kW, 400V, 3 phase 4 pole 1450 rpm, delta connected induction motor. Average flux density is 0.45 Wb/m^2 . $a_c = 23500$ ampere conductors/ m. Full load efficiency is 0.9 at a power factor of 0.8. Length of stator core to pole pitch is 1. The stator employs a double layer winding. (10)
- 17 a) What are the advantages of hybrid methods? (5)
b) Explain the synthesis method of electrical machine design with a flow chart. (5)
