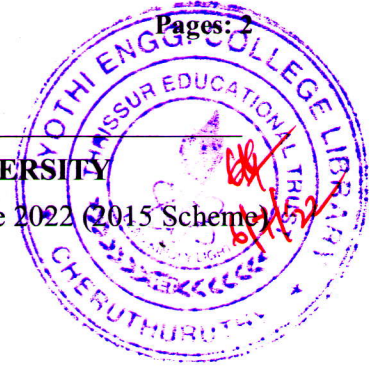


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Supplementary Examination June 2022 (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 | List any four components of armature leakage flux. | (5) |
| 2 | Derive the width of window of a transformer which will give maximum output. | (5) |
| 3 | What are the factors to be considered when selecting a suitable value of core length of a dc motor? | (5) |
| 4 | Derive the output equation of synchronous machine. | (5) |
| 5 | What are the factors to be considered to estimate the length of air gap in three-phase induction machines? | (5) |
| 6 | Explain the design of end rings in a three-phase squirrel cage induction motor. | (5) |
| 7 | Explain the hybrid technique of computer aided design of electrical machines. | (5) |
| 8 | List out the limitations of finite element method. | (5) |

(8 x 5 = 40 Marks)**PART B***Answer any two full questions, each carries 10 marks.*

- | | | |
|----|--|------|
| 9 | A 175MVA, 20 pole, water wheel generator has a core of length 1.72m and a diameter of 6.5m. The stator slots(open) have a width of 22mm, the slot pitch being 64mm and the air gap length at the centre of the pole is 30mm. There are 41 radial ventilating ducts each 5mm wide. The total mmf per pole is 27000A. The mmf required for the air gap is 87% of the total mmf per pole. Estimate the average flux density in the air gap if the field form factor is 0.7. | (10) |
| 10 | Design the core, window, yoke and overall dimensions of a 25kVA, 11000/433V, 50Hz, 3 phase, delta/star, core type, oil immersed natural cooled distribution transformer. Assume a cruciform core. | (10) |
| 11 | a) Derive the ratio of gross core area to area of circumscribing circle for a square cored transformer. | (5) |
| | b) Explain unbalanced magnetic pull in rotating electric machines. | (5) |

(2 x 10 = 20 Marks)

PART C

Answer any two full questions, each carries 10 marks.

- 12 A 350kW, 500V generator has 8 poles, an armature diameter of 1.3m, and a core length of 0.35m. A duplex wave winding is accommodated in 114 slots with 6 coil sides per slot. The axial length of commutating poles is 0.2m. and the gap length under commutating poles is 10mm. Find the necessary mmf for each interpole if the specific permeance is 6×10^{-6} . Find also the number of turns. (10)
- 13 a) Explain the step by step design procedure for armature of a dc machine. (5)
 b) Explain the field design of turbo alternators. (5)
- 14 a) What are the advantages and disadvantages of large air gap in the design of synchronous machines? (4)
 b) Determine the main dimensions, peripheral speed and run-away speed for a 1000kVA, 50Hz, three-phase, 375rpm alternator. The average air gap flux density is 0.55wb/m^2 and the specific electric loading is 28000 ampere-conductors per meter. Use rectangular pole construction and assume a suitable value for the ratio of core length to pole pitch in order that bolted on pole type construction is adopted where the maximum permissible speed is 50m/s. The run-away speed is 1.8 times the peripheral speed. (6)

(2 x 10 = 20 Marks)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) What are the rules for selecting rotor slots in a three-phase squirrel cage induction motor? (4)
 b) What do you mean by the wound rotor type rotor construction of a three-phase induction motor? Explain the design of wound rotor of a three-phase induction motor. (6)
- 16 a) Determine the main dimensions, stator turns per phase, number of stator slots, and number of conductors per stator slot of a 3.7kW, 400V, three-phase, 4 poles, 50Hz, delta connected squirrel cage induction motor. Assume that the average air gap flux density = 0.45wb/m^2 , specific electric loading = 23000 ampere-conductors per meter, efficiency = 85%, power factor = 0.84, winding factor = 0.955. (5)
 b) Explain the various types of computer aided design softwares. (5)
- 17 What is finite element analysis? Explain the historical background of finite element method. What are the advantages and applications of this method? (10)

(2 x 10 = 20 Marks)
