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Question Paper Code: 36302

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Sixth Semester

Electrical and Electronics Engineering

01UEE602 - ELECTRICAL MACHINE DESIGN

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What do you mean by H type insulation? Give an example.
2. Mention the different types of duties of a machine.
3. What are the deciding factors in design of armature?
4. Mention the factors governing the choice of armature slots in a dc machine.
5. List the different methods of cooling of transformer.
6. State the considerations in the design of transformer tank.
7. Mention the rules for selecting rotor slots of squirrel cage induction motor.
8. Why induction motor is called as rotating transformer?
9. Define short circuit ratio of synchronous machine.
10. State the factors for separation of D and L for cylindrical rotor machine.

PART - B (5 x 16 = 80 Marks)

11. (a) For a certain DC generator the core loss is 1000 W and the armature resistance is $0.025\ \Omega$. The core and windings form a cylinder 0.25 m long and 0.25 m in diameter. Specific loss dissipation is $230\text{ W/m}^2\text{-}^\circ\text{C}$. Calculate the specific electric loading which would result in windings and core having a temperature rise of 40°C . The machine is wave wound with 270 armature conductors. Assume that the heat is dissipated from the cylindrical surface only. (16)

Or

- (b) Explain the following:

(i) Major considerations in electrical machine design. (8)

(ii) Thermal considerations in design. (8)

12. (a) State and explain the factors which govern the choice of specific magnetic loadings. (16)

Or

- (b) Explain the following

(i) Guiding factors for selection of poles (8)

(ii) Unbalanced magnetic pull. (8)

13. (a) A 250kVA , $6600/400\text{V}$, 3 phase core type transformer has a total loss of 4800 Watts on full load. The transformer tank is 1.25m in height and $1\text{m}\times 0.5\text{m}$ in Plan. Design a suitable scheme for cooling tubes if the average temperature rise is to be limited to 35°C . the diameter of the tube is 50mm and spaced 75mm from each other. The average height of the tube is 1.05m . (16)

Or

- (b) (i) Derive the output equation of transformer. (8)

(ii) Different methods of cooling of transformer. (8)

14. (a) Evaluate the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250 HP , 3- Phase, 50 Hz , 400 V , 1410 rpm slip ring induction motor. Assume average flux density in the air gap = 0.5 Wb/m^2 , ampere conductor/meter = $30,000\text{ A/m}$, efficiency = 0.9 and power factor = 0.955 , current density = 3.5 A/mm^2 . The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2 . The machine is delta connected. (16)

Or

- (b) (i) Discuss the factors to be considered for selection of rotor slots of squirrel cage machine. (10)
- (ii) Explain how the magnetizing current and short circuit current influence the performance of induction motor drive. (6)

15. (a) Explain all the valid points regarding armature design of synchronous machine. (16)

Or

- (b) Estimate the diameter, core length, size and number of conductors, number of slots for stator of a 15 MVA, 11 KV, 50 Hz, 2 pole star connected turbo - with 60° phase spread. Assume average flux density in the air gap is $= 0.55 \text{ Wb/m}^2$; electric loading $= 36,000 \text{ A/m}$; current density $= 5 \text{ A/mm}^2$; peripheral speed $= 160 \text{ m/s}$. The winding should be arranged to eliminate 5th harmonic. (16)
