

- (c) (1) Write a short note on : Class of insulation materials. 5
- (2) Discuss hydrogen cooling in brief. 5
- 2 (a) An induction motor has final steady temperature rise of 40°C when running at its rated output. Calculate its half hour rating for the same temperature rise if the copper loss at rated output are 1.25 times its constant losses. The heating time constant is 90 min. 6
- (b) Derive expression temperature rise of a machine when it is started from cold condition and running under steady load condition. 6

OR

- (a) A field coil has a cross section of $120 \times 50 \text{mm}^2$ and its length of mean turn is 0.8 m. It dissipates 150 W continuously. Its cooling surface is 0.125 m^2 and specific heat dissipation is $30 \text{ W/m}^2\text{-}^{\circ}\text{C}$. Calculate the final steady temperature rise of the coil surface. Also calculate the hot spot temperature rise of the coil if the thermal resistivity of insulating material used is $8 \Omega\text{-m}$. Assume space factor = 0.56. 6
- (b) Explain various methods used for determining rating of a rotation machine. 6
- 3 Attempt any "Three" 18
- (1) A copper bar 15 mm in diameter is insulated with micanite tube which fits tightly around the bar and in the rotor slot of an induction motor. The micanite tube is 1.5 mm thick and its thermal resistivity is $8 \Omega\text{-m}$. Calculate the loss that will pass from copper bar to iron if a temperature difference of 20°C is maintained between them. The length of bar is 0.3 m.

- (2) What is apparent flux density ? Discuss how to calculate it for slotted armature.
- (3) What do you mean by 'Ventilation' in case of rotation machines ? Discuss types of ventilation used in rotating machines.
- (4) Discuss : Effect of airgap and ventilating ducts on mmf calculation in terms of contraction factors.
- 4 (a) Identify whether the following statements are true or false 5
- (1) Breather is used in the transformer to cool the oil.
- (2) Current transformer should never be operated with the secondary open circuited.
- (3) Hysteris losses in a transformer vary as the square of the maximum flux density.
- (4) Transformer oil should have good dielectric strength.
- (5) Starter used for D.C. shunt motor to reduce starting torque.
- (b) A 250 V, 370 kW, D.C. shunt motor has to exert a maximum torque of 150 % of full load torque during the starting period. The resistance of armature circuit is 0.2 ohm and the full load efficiency is 84%. The number of studs is 8. Determine: 1> the upper and lower limits of current during starting. 2> the resistance of each section. 10
- (c) Compare distribution and power transformer. 5
- 5 (a) Derive the condition to be satisfied for designing a transformer so as to have minimum cost. 8

- (b) Calculate approximate overall dimensions 7
for a 200kVA, 6600/440V, 50Hz, three phase core type transformer.

The following data may be assumed :

Emf/turn=10V, Maximum flux density=1.3wb/m², current density = 2.5A/mm², window space factor = 0.3, overall height = overall width, staking factor = 0.9, use 3-stepped core.

OR

- (a) Discuss different types of windings used in transformers in brief. 8
- (b) Derive the basic equation used in the design of choke coil. 7

6 Answer 'any three'. **15**

- (1) Compare core type and shell type transformers.
- (2) Derive the output equation of single phase transformer.
- (3) Explain construction of the single and three phase transformer in brief.
- (4) Explain the methods of cooling of transformer.
- (5) Obtain the basic equation required in the design of horse-shoe type electromagnet.