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Total No. of Questions : 08

M.Tech. (Power System) (2018 Batch) (Sem.–2)

POWER APPARATUS DESIGN

Subject Code : MTPS-203D-18

M.Code : 76137

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1.Attempt any FIVE questions out of EIGHT questions.

2.Each question carries TWELVE marks.

1. a) Explain why higher specific electric loading can be used in machines using copper conductor compared to those using aluminium conductors.

   b) Prove that I^2R loss per unit mass of the conductor material is = $\delta^2\rho/g$, where δ is current density, ρ is resistivity and g is volume density.

2. a) Determine the dimension of core and yoke of 200 Kva, 50 Hz single phase core type transformer. A square core is used with adjacent distance between the limb is equal to 1.6 times the width of the laminations. Assume voltage per turn of 14 volts, maximum flux density of 1.1 wb/m^2, the window space factor is equal to 0.32, the current density 3 A/mm^2. Take stacking factor 0.9. Flux density of yoke is 80% of the core flux density.

   b) Obtain the expression for leakage reactance of single phase core type distribution transformer

3. a) Define the Phenomena of Cogging and Crawling in the induction motor. What steps should be taken in the design consideration to avoid these phenomena?

   b) Give important consideration for the choice of types of slots in stator winding of synchronous machine.

4. A 500 kVA 3.3 kV, 50 Hz, 600 rpm 3- phase sailent pole alternator has 180 turn per phase. Estimate the length of the air gap if the average flux density is 0.6 wb/ m^2. The ratio of pole arc to pole pitch 0.66, the short circuit ratio is 1.2 and gap extension coefficient is 0.15. The mmf required for the gap is 80% of no load mmf and winding factor is 0.995.

5. Derive the expression for the output equation of DC machine in terms of its volume. Also discuss the effect of specific loading and speed on the size of machine.

6. a) Show that the gross area of 3-stepped transformer core is approximately 85% area of the circumscribing circle.

   b) Explain the terms continuous duty, short time duty and intermittent periodic duty as applied to the electric machine.

7. Prove from first principle that for rotating machine output in volt amp is $C_o D^2 L_n$. Show fully how and why the output coefficient C_o change with size and type of machine and show that in all designs, it approaches a fixed maximum value.

8. Write short notes on the following :

   a) Energy efficient machines

   b) Forces winding during short-circuit

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.