UNIT 3 – TRANSFORMERS

PART - A

1. What is meant by window space factor?
2. What are the advantages of having circular in a transformer?
3. What are the different losses in a transformer?
4. State the merits of three phase transformers over single phase transformer.
5. Distinguish between shell type and core type transformer.
6. What are the salient features of a distribution transformer?
7. How the distribution transformer differs from that of a power transformer?
8. In transformers, why low voltage winding is placed near the core.
9. The area of the yoke in a transformer is taken 15 to 20% larger than that of the core. why?
10. What you mean by stacking factor? What its usual value?
11. What is tertiary winding?
12. The voltage per turn of a 500KVA, 11KV, Δ/Y three phase transformer is 8.7V calculate the number of turns per phase of LV and HV windings
13. What are conservator and breather?
14. List out the advantages and disadvantages of stepped core transformer.
15. State the various methods of cooling of power transformers.
16. How the heat dissipation is improved by the provision of cooling tubes?
17. Why is the core of a transformer laminated?
18. Write the relation between core area and weight of iron and copper for a single phase transformer.
19. Comment on the hysteresis and eddy current loss when voltage and frequency of a transformer is doubled.
20. Explain the significance of the ratio $r=\Phi m/AT$ in the design of transformer.

PART- B

1. Estimate the main dimensions including winding conductor area of a 3 phase delta-star core type transformer rated at 300KVA, 6600/400 V, 50 Hz. A suitable core with 3 steps having a circumscribing circle of 0.25m diameter and leg spacing of 0.4 m is available. EMF / turn = 8.5 V, δ = 2.5 A /mm^2, k_w=0.28 and S_f = 0.9 (stacking factor)
   (10)
2. Derive the output equation of a single phase transformer (6)
3. Determine the main dimensions of the core, the number of turns, the cross sectional area of conductors in primary and secondary windings of a 100 kVA, 2200 / 480 V, 1-phase, core type transformer, to operate at a frequency of 50Hz, by assuming the following data. Approximate volt per turn = 7.5 volt. Maximum flux density = 1.2Wb/ 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 = 0.28. Current density = 2.5A/mm^2.
(10)

4. Estimate the no-load current of a three phase transformer. (6)

5. For a transformer show that the emf per turn Et=K √KVA. Where KVA= rating of transformer. What are the factors on which the value of K depends on? (6)

6. Discuss about cooling of transformer using cooling tubes. (8)

7. Calculate the no load current of a 400V, 50Hz single phase core type transformer which has the following particulars: Length of mean magnetic path =200cm; Gross core section=100cm^2; Maximum flux density 0.7 Tesla; Specific core loss at 50 Hz and 0.7 T =2.1W/kg; Stacking factor 0.9; Density of core material 7.5X10^{3}kg/m^3. The effective joint is equivalent to that of an airgap 0.1 mm in the magnetic circuit.

8. Determine the core and yoke dimensions for a 250 kVA, 50Hz, single phase, core type transformer, EMF per turn = 12 V, the window space factor = 0.33, current density = 3A / mm^2 and B_{max} = 1.1 T. The distance between the centers of the square section core is twice the width of the core. (6)

9. Calculate the dimensions of the core, the number of turns and cross sectional area of conductors in the primary and secondary windings of a 250 kVA, 6600/400 V, 50 Hz, single phase shell type transformer. Ratio of magnetic to electric loadings = 560 x 10-8, Bm = 1.1 T. _ = 2.5 A / mm2, Kw = 0.32, Depth of stacked core / width of central limb = 2.6; height of window / width of window = 2.0. (10)

10. The tank of 1250 kVA, natural oil cooled transformer has the dimensions length, width and height as 0.65 x 1.55 x 1.85 m respectively. The full load loss = 13.1 kW, loss dissipation due to radiations = 6 W / m2-°C, loss dissipation due to convection= 6.5 W / m2°C, improvement in convection due to provision of tubes = 40%, temperature rise = 40°C, length of each tube = 1m, diameter of tube = 50mm. Find the number of tubes for this transformer. Neglect the top and bottom surface of the tank as regards the cooling. (16)

11. Calculate the main dimensions and winding details of a 50kVA, 2000/400V, 50Hz single-phase shell type oil immersed, self cooled transformer. Voltage per turn 10V, flux density in core =1.1wb/m^2, current density=2A/mm^2, window space factor=0.33. Assume the height of the window is 3 times its width and depth is 2.4 times width of central limb.

12. Determine the dimensions of the core and yoke for a 200 kVA , 50Hz, single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn of 14 Volts, maximum flux density of 1.1 Wb/m^2, window space factor of 0.32, current density of 3 A/mm^2 and stacking

factor w equal to 0.9. the net iron area of 0.56 d^2 where d is diameter of circumscribing circle. Width of the largest stamping is 0.85d.

13. A 250kVA, 6600/400V, three phase core type transformer has total loss of 4800W at full load. The transformer tank is 1.25m in height and 1m X 0.5m in plan. Design a suitable scheme of tubes if the average temperature rise is to be limited to 35^0C. The diameter of each tube is 50 mm and the tubes area spaced 75mm from each other. The average height of each tube is 1.05m. Specific heat dissipation due to radiation and convection is respectively 6 and 6.5W/$m^2/^0$C. Assume that convection is improved by 35% due to provision of tubes.

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