

Total No. of Questions : 6]

SEAT No. :

P518

[Total No. of Pages : 2

APR - 18/TE/Insem. - 118

T.E. (Electrical)

DESIGN OF ELECTRICAL MACHINES

(2015 Course) (Semester - II) (303149)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of log table, calculator and steam table is permitted.*

Q1) a) Compare power transformer with distribution transformer on following points : **[3]**

- i) Range of maximum flux density.
- ii) Volts per turn.
- iii) Range of loading for maximum efficiency.

b) A 300 kVA three phase transformer has full load efficiency at 0.8 power factor lagging of 98.5 percent. For the purpose of cooling, the transformer may be considered to be 1400 kg of homogeneous material having a specific heat of 750 J/kg-°C and a surface area of 10 m², the surface emitting heat at 12.5 W/m²-°C. Find the thermal constant and full load temperature rise. **[7]**

OR

Q2) a) Define and state the units of heating time and cooling time constant. **[5]**

b) Why pressure release valve is used in oil immersed transformer? With a neat diagram explain its construction. **[5]**

Q3) a) Derive the expression for output equation of single phase transformer. **[4]**

b) A three phase 15 MVA, 33/6.6 kV, 50 Hz, star/delta core type oil immersed natural cooled transformer gave the following design parameters. Length of core + 2 times height of yoke = 250 cm, centre to centre distance of cores = 80 cm, outside diameter of the HV winding = 78.5 cm, iron losses = 26 kw, copper loss in both windings = 90 kW respectively. Calculate the main dimensions of the tank, temperature rise of the transformer without cooling tubes, and number of tubes for a temperature

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rise not to exceed 50°C. Assume height clearance of 50 cm, length and width clearance of 11.5 cm each, average length of tube 2, 7 m and diameter of tube 50 mm. [6]

OR

- Q4)** a) Draw the front and sectional top view of the core of three phase core type transformer and show the width of window, height of window, diameter of circumscribing circle, height of yoke, width of largest stamping, overall height and overall height, assume cruciform core. [4]
- b) Determine the main dimensions of the core of three phase 350 kVA, 11000/3300 V, star / delta, 50 Hz core type transformer. Assume : Volt / turn = 11, maximum flux density = 1.25 T. Net cross-section of core = $0.6 d^2$, window space factor = 0.27, window proportion = 3 : 1, current density = 250 A/cm². [6]
- Q5)** a) Without performing any test explain the procedure to determine full load copper loss of a three phase distribution transformer. [6]
- b) State advantages and disadvantages of computer aided design of transformer. [4]

OR

- Q6)** a) Draw the flow chart of computer aided design of three phase power transformer. [4]
- b) A 400V/230V, single phase transformer has gross iron area of $3 \times 10^{-3} \text{ m}^2$. The length of the flux path is 2 m with relative permeability of 950. The high voltage winding has 600 turns. Calculate the maximum flux density in the core and the magnetizing component of no load current of the transformer. Assume the stacking factor as 0.9 and frequency as 50 Hz. [6]

