Total No. of Questions : 6]

SEAT No. :

P17

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APR - 18/TE/Insem. - 19

T.E. (Electrical)

DESIGN OF ELECTRICAL MACHINES

(2012 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 side indicate full marks.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain in brief various modes of heat dissipation. **[4]**

b) A 200 kVA transformer has an efficiency of 98.5% at full load and 0.9 power factor. For the purpose of cooling transformer 1500 kg of homogeneous material having specific heat of 700 J/kg°C and surface area of 10 m^2, the surface is emitting heat at 12 W/m^2-°C. Find the thermal time constant and full load temperature rise. **[6]**

OR

Q2) a) Write a note on any two types of transformer winding. **[4]**

b) The temperature rise of a transformer is 25°C after one hour and 37.5°C after two hours of starting from cold condition. Calculate the final steady temperature rise and the heating time constant. If its temperature falls from the final steady value to 40 °C in 2.5 hours when disconnected, calculate its cooling time constant. The ambient temperature is 30 °C.**[6]**

Q3) a) Draw sectional view of limb of core type single phase transformer. **[2]**

b) Calculate overall dimensions for a 200 kVA, 6600/440V, 50 Hz, three phase core type transformer. The following data may be assumed : emf per volt = 10V, maximum flux density = 1.3 Wb/m^2, current density = 2.5 A/mm^2, window space factor = 0.3, overall height = overall width, stacking factor = 0.9. Use three stepped core. **[8]**

OR

P.T.O.

Q4) a) Derive the expression of axial force produced in case of core type transformer. **[4]**

b) Calculate the KVA output rating of single phase transformer from the following data : **[6]**

i) Ratio of height of window to distance between core centers = 2.4.

ii) Ratio of diameter of circumscribing circle to distance between core centers = 0.6.

iii) Ratio of diameter Net iron area to area of circumscribing circle = 0.8.

iv) Current density = 2.61 A/mm^2.

v) Window space factor $k_w = 0.3$.

vi) Frequency = 50 Hz.

vii) Maximum Flux Density in core area $B_m = 1.22$ T.

viii) Distance between core centers D = 0.38 m.

Q5) a) Explain the procedure to estimate the resistance of a designed three transformer. **[5]**

b) Write a generalized flow chart for design of transformer. **[5]**

OR

Q6) a) What is meant by bracing of transformer winding? **[3]**

b) A single phase 400/230 V, 50 Hz, transformer is built from stampings having a relative permeability of 1200. The length of the flux path is 2.6 m, the area of cross section of the core is 2.7×10^{-3} m^2 and the primary winding has 740 turns. Estimate the maximum flux and no load current of the transformer. The iron loss at the working flux density is 2.6 W/kg. Iron weighs 6×10^3 kg/m^3. Stacking factor is 0.9. **[7]**