Total No. of Questions : 6]

SEAT No. :

P181

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APR - 17/TE/Insem. - 17

T.E. (Electrical)

DESIGN OF ELECTRICAL MACHINE

(2012 Pattern) (Semester - II)

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) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Write various specifications of a transformer as per IS 2026 part-I. **[4]**

b) Write functions of **[2]**

i) Tap changer.

ii) Conservator & breather.

c) State & explain modes of heat dissipation. **[4]**

OR

Q2) a) What are different types of windings used in a transformer? Explain any one. **[4]**

b) A 1000 A shunt consists of 8 strips nickel alloys connected in parallel, each having a cross section of 25×2 mm^2. The normal voltage drop is 75mV. The alloy used has the following data:-

resistivity = $0.4\times10^{-6}\ \Omega$.m

Specific heat = 500 J/kg-ºC,

Specific gravity = 8000 kg/m^3,

rate of heat dissipation = 100 watts/m^2-ºC

Determine the maximum temperature rise and the time taken to reach 99% of maximum value. **[6]**

P.T.O.

Q3) a) Obtain an expression for leakage reactance of a three phase core type transformer. **[4]**

b) Calculate approximate overall dimensions of a 200KVA, 6600/440V, 50Hz, 3ϕ core type transformer. The following data may be assumed; emf/turn =10V, Maximum flux density = 1.3 Wb/m^2, current density = $2.5A/mm^2$, Window space factor = 0.3, Overall height = Overall Width, Stacking factor = 0.9.

Use 3- stepped core, Width of largest stamping = 0.9 d. & net iron area $=0.6d^2$. Where d is diameter of circumscribing circle. **[6]**

OR

Q4) a) Derive the output equation of a three phase transformer with usual notation. **[4]**

b) A 250 KVA, 6600/400V, 3ϕ core type transformer has total loss of 4800 watts at full load. The transformer tank is 1.25 m in height & 1m×0.5m in plain. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35ºC. The diameter of tubes is 50mm and are spaced 75mm from each other. The average height of tubes is 1.05m. Specific heat dissipation due to radiation & convection is respectively 6 & 6.5 W/m^2-ºC. Assume that convection is improved by 35% due to provision of tubes. **[6]**

Q5) a) Explain mechanical radial forces developed under short circuit condition in a transformer. **[4]**

b) Explain the procedure to estimate the no load current of a three phase transformer. **[6]**

OR

Q6) a) Draw & explain generalised flow chart for design of transformer. **[4]**

b) A single phase, 400V, 50Hz, transformer is built from stampings having a relative permeability of 1000. The length of flux path is 2.5m, the area of cross section of the core is 2.5×10^{-3} m^2 & the primary winding has 800 turns. Estimate the maximum flux & the no load current of the transformer. The iron loss at the working flux density is 2.6 W/Kg. Iron weight is 7.8×10^3 Kg/m^3. Stacking factor = 0.9. **[6]**

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