Total No. of Questions : 08]

SEAT No. :

P1738

[Total No. of Pages : 3

[5460] - 568
T.E. (Electrical)
DESIGN OF ELECTRICAL MACHINES
(2015 Pattern)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Explain the mechanical forces developed under short circuit condition in a transformer and the measures to overcome them. **[6]**

b) Explain Specifications of three phase transformers as per IS 2026. **[4]**

c) Determine the dimensions of core and yoke for a 200 KVA, 50 Hz, single phase core type transformer. A cruciform core is used with distance between the adjacent limbs equal to 1.6 times the width of the core laminations. Assume voltage per turn 14V, flux density = 1.1 wb/m^2, window space factor = 0.32, current density = 3 A/mm^2. The net iron area is $0.56d^2$, width of largest stamping = 0.85d. Also calculate the overall width and height of the frame. **[10]**

OR

Q2) a) Derive the condition for optimum design of transformer for minimum loss or maximum efficiency. **[6]**

b) Explain the different Modes of heat dissipation. **[4]**

c) A 6600 V, 60 Hz, single phase transformer has a core of sheet steel. The net iron cross sectional area = 22.6×10^{-3} m^2. The mean length is 2.23m. There are four lap joints and each joint takes $\frac{1}{4}^{th}$ time as much reactive mmf as it is required per metre of the core. The flux density is 1.1 Wb/m^2. Find the number of turns on the 6600 V winding and no load current. Assume the peak factor as = 2.149, mmf/m = 232 A/m, specific loss = 1.76 W/Kg and density of plates = 7.5×10^3 kg/m^3 **[10]**

P.T.O.

Q3) a) Define specific electrical and magnetic loadings. Explain the factors to be considered for the choice of specific electrical and magnetic loading. **[8]**

b) Derive the Output equation for three phase induction motor with usual notations. **[8]**

OR

Q4) a) Explain any two types of AC windings. **[8]**

b) Explain the various factors in detail which play a major role while deciding the number of stator slots. **[8]**

Q5) a) Explain the various factors that are to be considered while deciding the length of air gap. **[8]**

b) Find the main dimensions of a three phase 10 Kw, 400 V, 50 Hz, 4 pole squirrel cage induction motor having efficiency = 0.85, power factor = 0.86, Bav = 0.4 Wb/m^2, Specific electric loading = 20000 A/m, winding factor = 0.955. Take the rotor peripheral speed as 20 m/sec. **[8]**

OR

Q6) a) What is Unbalanced Magnetic Pull (UMP) and what are the practical aspects of it? **[8]**

b) A 11 KW, three phase, 50 Hz, 6 pole, 220 V, Star connected Induction motor has 54 stator slots each containing 9 conductors. The number of rotor bars is 64. Find the bar current, end ring current, area of bar section, area of end ring section. Assume that efficiency = 0.86, power factor = 0.85, rotor mmf is 85% of stator mmf and current density in the bar and end ring is 5 A/mm^2. **[8]**

Q7) a) Explain the different types of leakage flux in an induction motor. **[6]**

b) Explain the calculation of MMF in case of an induction motor. **[6]**

c) A 25 KW, 1500 rpm, three phase, 50 Hz, 4 pole, 415 V, delta connected induction motor has flux equal to 20 mwb and area is 500 cm^2. The length of air gap is 0.6 mm. The gap contraction factor is 1.533 and mmf for iron parts is 25% of mmf for air gap. Find the magnetizing current. Assume the stator winding factor as 0.955. **[6]**

OR

Q8) a) Explain the short time and continuous rating of electrical machine. **[6]**

b) Explain the effect of ducts on the calculation of magnetizing current. **[6]**

c) A 75 KW, 3300 V, 50 Hz, 8 pole, three phase, star connected Induction motor has magnetizing current equal to 35% of full load current. Find the stator turns per phase if the mmf required for flux density at 60° from the interpolar axis is 500 A. Assume the stator winding factor as 0.955. efficiency = 0.94, power factor = 0.86. **[6]**

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