Total No. of Questions : 8]

SEAT No. :

P3296

[Total No. of Pages : 3

[5353]-169

T.E. (Electrical)

DESIGN OF ELECTRICAL MACHINES

(2012 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q. No.1 OR Q. No.2 & Q. No. 3 OR Q. No.4 & Q. No. 5 OR Q. No. 6 & Q. No. 7 OR Q. No 8.***
2) ***Assume suitable data wherever necessary.***
3) ***Figures to the right in Bold indicate maximum marks.***
4) ***Use of non-programmable scientific calculator is permitted.***
5) ***Neat figures must be drawn wherever necessary.***

Q1) a) Derive output equation of single phase shell type transformer. **[5]**

b) Compare power transformer with distribution transformer in terms of design parameters. **[5]**

c) Write short notes on cross over and disc windings used in transformer. **[10]**

OR

Q2) a) What are different methods of cooling transformer? How transformers are classified based on cooling draw a diagram for each. **[6]**

b) A three phase slipring induction motor has a final steady temperature rise of 40°c when running at its rated output. Calculate its half hour rating for the same temperature rise if the copper loss at rated output is 1.25 times its constant loss. The heating time constant is 90 minutes. **[6]**

c) What types of forces are developed in transformer winding under short circuit condition? With a neat diagram explain any one in detail. **[8]**

Q3) a) Write note on double layer winding. Why double layer winding is used universally for armatures of three phase ac machines. **[8]**

b) Draw a mush winding diagram for 4 pole, 36 slot three phase induction motor armature. Use full pitched coil. Show connection for all three phases. **[10]**

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OR

Q4) a) Derive output equation of three phase induction motor. **[8]**

b) Determine the main dimensions, turns per phase, area of conductor, number of slots of a 250 HP, 3 phase, 50Hz, 415v, 1450rpm delta connected slip ring induction motor having following data: B_{AV} = 0.5 Wb/m^2, ac = 30000 A/m, Efficiency = 90%, power factor = 0.9, winding factor = 0.955, current density = 3.5A/mm^2, the ration of core length to pole pitch = 1 and slots/pole/phase =5. **[10]**

Q5) a) What are the factors considered when estimating the length of the air gap of Induction motor? How these factors are affected by the air gap length. Why the length of the air gap should be as small as possible. **[8]**

b) Derive the expression of unbalanced magnetic pull in case of Induction motor. **[8]**

OR

Q6) a) State any four rules for selecting the number of rotor slots of three phase squirrel cage induction motor. **[4]**

b) During the stator design of a 3 phase, 30 kW, 400volts, 6 pole, 50Hz, delta connected squirrel cage induction motor following data has been obtained. Gross length of the stator = 0.17 m, Internal diameter of stator = 0.33 m, Number of stator slots = 45 Number of conductors per slot = 12. Based on the above design data design a suitable rotor. Assume suitable data. **[12]**

Q7) a) Why does skewing lowers the power factor and overload capacity. **[8]**

b) Estimate the magnetizing current of a 415V, three phase, 50Hz, 4 pole induction motor whose stator core diameter and length is 0.21m and 0.15m respectively. The effective air gap length is 0.5mm. The stator is delta connected with double layer winding with winding factor of 0.955 and gap contraction factor of 1.2; the stator has 4 slots per pole per phase having 28 conductors/slot. The ampere turns for the iron path may be taken as 45% of the air gap ampere turns. **[8]**

OR

Q8) a) Step by step write down the procedure to calculate the magnetizing component of no load current of three phase induction motor. **[8]**

b) Explain with neat sketches different types of leakage fluxes in an induction motor. **[8]**