Total No. of Questions : 8]

SEAT No. :

P290

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T.E. (Electrical)

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

(2019 Pattern) (Semester-II) (303149)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right side indicate full marks.*

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

b) Explain the procedure for the calculation of no load current in the three phase transformer. **[6]**

c) A 600 KVA, 6600/400 V, 50 Hz, three phase core type transformer has: Width of LV winding = 3CM, Width of HV winding = 3 cm, width of duct between LV and HV = 2 CM, height of HV and LV windings = 40 cm, length of mean turns =1.5m, HV winding turns = 220, $\mu_0 = 4\pi \times 10^{-7}$ H/m. Estimate the leakage reactance of the transformer referred to the HV side. **[6]**

OR

Q2) a) State the various assumptions made during the calculation of leakage flux and leakage reactance. **[6]**

b) Draw the generalized flow chart of computer aided design of a transformer. **[6]**

c) A single phase, 400V, 50 Hz transformer is built from stampings. The length of the flux path is 2.5 m. The net iron area is 2.25×10^{-3} m^2. The number of primary turns are 800. The iorn loss at the working flux density = 2.6 W/Kg, stacking factor = 0.9, weight of iron is 7.8×10^3 Kg/m^3. Total magnetizing mmf is 1989 A. Calculate the no load current of the transformer. **[6]**

Q3) a) Determine the main dimensions of a 250 H.P three phase, 50 Hz, 400 V, 1410 rpm, 4 pole, slip ring induction motor. Assume the following data:efficiency =0.9, power factor=0.9 specific magnetic loading=0.5 wb/m^2 , specific electric loading=30,0000 A/M, Winding factor=0.955, ratio of core length to core pole pitch= 1.2. The motor is delta connected. Assume the nearest synchronous speed as 1500 rpm. **[10]**

b) Explain the types of AC windings. (any two) **[7]**

OR

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Q4) a) Derive the output equation of a three phase induction motor and also state the significance of the terms involved. **[7]**

b) Explain the specific electric loading and the various factors responsible for the choice of specific electric loading. **[10]**

Q5) a) Explain the design of rotor slots, rotor bars and end rings for a squirrel cage induction motor. **[10]**

b) For a three phase, 50Hz, 10 KW, 4 pole, 400v star connected induction motor consider the following details: diameter of stator= 15 cm, average flux density=0.45 wb/m^2. Length of stator core=9 cm, power factor=0.86, number of stator slots=36, efficiency=84%, current density=5 A/ mm^2, number of rotor slots=30, number of conductors/ slot for stator=12. Design the rotor bar section and end ring by calculating the rotor bar current, area of rotor bar, end ring current and area of end ring. Assume the rotor mmf as 85% of the stator mmf. **[8]**

OR

Q6) a) Derive the relation for the end ring current in terms of the bar current for a squirrel cage induction motor. **[10]**

b) Discuss the various factors which affect the choice of length of air gap for a three phase induction motor. Why generally the air gap should be as small as possible. **[8]**

Q7) a) Draw and explain the generalized flow chart for design of induction motor. **[5]**

b) A 75 KW, 3300 V, 50 Hz, 8 pole, three phase, and star connected induction motor has magnetizing current which is equal to 35% of full load current. Calculate the value of stator turns per phase if the mmf required for flux density at 60° from pole axis 500 A, winding factor= 0.95, efficiency=0.94, power factor=0.86 **[7]**

c) Explain the procedure to find out MMF required for air gap, stator teeth, and stator core, rotor teeth and rotor core of an induction motor. **[5]**

OR

Q8) a) With the help of neat sketches explain the different types of leakage fluxes in an induction motor. (any two) **[5]**

b) Explain the effects of ducts on calculations of magnetizing current. **[5]**

c) Estimate the magnetizing current of an 11 KV, 50 Hz, three phase, star connected, 12 pole induction motor. The stator diameter is 90 cm, length of stator bore is 25 cm, stator has 108 slots with 48 conductors per slot, average flux density is 0.6 wb/m^2. Ampere turns for iron parts can be assumed to be 45% of that required for air gap, stator winding factor = 0.955, and gap contraction factor = 1.093 and length of air gap is 1 mm. **[7]**

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