Total No. of Questions : 8]

SEAT No. :

P1715

[Total No. of Pages : 3

[5058]- 348
T.E. (Electrical)
DESIGN OF ELECTRICAL MACHINES
(2012 Course) (Semester - II) (End Sem.)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt 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) ***Assume suitable data, if necessary.***

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

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

c) Determine the dimensions of the core and yoke for a 100KVA, 50 Hz, single phase transformer. A square type core is used with distance between adjacent limbs equal to 1.6 times the width of laminations. Assume voltage per turn to be 14 volts, maximum flux density 1.1 wb/m^2, window space factor 0.32 and current density 3A/mm^2, take stacking factor = 0.9, Flux density in yoke to be 80% of Flux density in core. **[8]**

OR

Q2) a) Explain the short time rating and continuous rating of electrical Machines. **[6]**

b) Draw and explain generalized flow chart for design of transformer. **[6]**

c) The tank of 1250 KVA natural oil cooled transformer has the dimensions length, width and height as 1.55 m × 0.65 m × 1.85 respectively. The full load loss is 13.1 kw. Find the number of tubes for this transformer assuming specific heat dissipation due to radiation = 6 w/m^2 ^oC, specific heat dissipation due to radiation = 6.5 w/m^2 ^oC, improvement in convection due to provision of tubes = 40%, Temperature rise 40^oC, length of each tube = 1m, diameter of tubes = 50 mm, Neglect top and bottom surfaces of tank. **[8]**

P.T.O.

Q3) a) Derive output equation of a three phase induction motor with usual notation. **[8]**

b) Define specific electric and specific magnetic loading and explain various factors considered for choice of specific electric and specific magnetic loading of a three phase induction motor. **[8]**

OR

Q4) a) Discuss various constraints in the selection of suitable combination of stator and rotor slots. **[8]**

b) Find the main dimensions of a three phase, 10 kW, 400V, 50Hz, 4 pole squirrel cage induction motor, assume full load efficiency = 0.85, full load power factor = 0.86, specific magnetic loading = 0.4 wb/m^2, specific electric loading = 20000 A/m, winding factor = 0.955, and stacking factor = 0.9, Take rotor peripheral speed as 20 m/sec. **[8]**

Q5) a) What is unbalanced magnetic pull in a three phase induction motor and explain procedure of its estimation. **[8]**

b) Determine the main dimensions, turns per phase, number of slots, conductor cross-section and slot area of a 250 HP , three phase. 50Hz, 400V, 1410 rpm, slip ring induction motor. Assume B_{av} = 0.5wb/m^2, ac = 30000 A/m, efficiency = 0.9, and power factor = 0.9, winding factor = 0.955, current density = 3.5 A/mm^2, slot space factor = 0.4 and ratio = L/P = 1.2. The machine is delta connected. Assume 5 slots per pole per phase. **[8]**

OR

Q6) a) Explain the factors should be considered when estimating the length of air gap of three phase induction motor. Why the air gaps should be as small as possible? **[8]**

b) A 15kW, 3ϕ, 50Hz, 400V, 4 pole, star connected squirrel cage induction motor has 60 slots, each containing 7 conductors. The rotor slots are 50. Assume full load efficiency as 0.85, full load power factor as 0.9 and rotor mmf is 80% of stator mmf. Calculate the value of bar and end ring current. Also find the area of each bar and each end ring, if current density is 5/mm^2. **[8]**

Q7) a) State and explain with neat sketches different types of leakage fluxes in an induction motor and estimate slot leakage reactance in an induction motor. **[9]**

b) A 15kW, 400V, 3 phases, 50Hz, 6 pole induction motor has a diameter of 0.3m & the length of core 0.12m. The number of stator slots is 72 with 20 conductors per slot. The stator is delta connected. Calculate the value of magnetizing current per phase if the length of air gap is 0.55m. The gap contraction factor is 1.2. Assume the mmf required for the iron parts to be 35 per cent of the air gap mmf. Coil span = 11slots. **[9]**

OR

Q8) a) Explain the procedure to calculate the no load current of a three phase induction motor. **[8]**

b) Explain the effect of ducts on the calculation of magnetizing current of 3ϕ induction motor. **[6]**

c) What are the losses in a three phase induction motor? Explain in brief. **[4]**