Total No. of Questions : 8]

SEAT No. :

P2393

[Total No. of Pages : 3

[4758]-553

T.E. (Electrical)

DESIGN OF ELECTRICAL MACHINES

(2012 Course) (Semester - I) (End - Semester)

Time : 3 Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer Q.No.1 or 2, Q.No.3 or 4, Q.No.5 or 6, Q.No.7 or 8.***
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) Explain in brief various modes of heat dissipation. **[5]**

b) Derive the output equation of a three phase transformer with usual notation. **[5]**

c) Estimate the P.U. regulation at full load & 0.8 p.f. lagging for 300KVA, 50 Hz, 6600/400v, three phase, delta-star, core type transformer. The data given as H.V. winding, - outside diameter = 0.36m, inside diameter = 0.29 m, area of conductor = 5.4 mm^2, L.V. winding, - outside diameter = 0.26m, inside diameter = 0.22m, area of conductor = 170 mm^2, length of coils = 0.5m, voltage/turn = 8v, resistivity = 0.21 ohms/m/mm^2. **[10]**

OR

Q2) a) Explain the short time rating and continuous rating of Electrical Machines. **[5]**

b) Discuss mechanical forces developed under short circuit condition in a transformer and measures to overcome this effect. **[5]**

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c) A 200 KVA, 6600/400V, three phase transformer, delta/star connected, 50 Hz, core type transformer has the following particulars: Maximum flux density = 1.3 wb/m^2, current density = 2.5 A/mm^2, window space factor = 0.3,

Overall height = overall width and use three stepped core, stacking factor = 0.9, emf per turn = 10 volts. Width of largest stamping = 0.9d and net iron area = $0.6d^2$. Calculate overall core dimensions. **[10]**

Q3) a) Derive output equation of a three phase induction motor with usual notation. **[6]**

b) Explain harmonic field effects on the performance of three phase induction motor. **[6]**

c) State different types of ac windings and explain any two. **[6]**

OR

Q4) a) 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. **[6]**

b) Discuss various constraints in the selection of suitable combination of stator and rotor slots. **[6]**

c) Find the main dimension of a 15kW, 3 phases, 400V, 50Hz, 2810 r.p.m. squirrel cage induction motor having an efficiency of 0.88 & a full load power factor of 0.9. Assume: specific magnetic loading = 0.5 Wb/m^2; specific electric loading = 2500A/m. Take the rotor peripheral speed as approximately 20m/s at synchronous speed. **[6]**

Q5) a) Explain the factors should be considered when estimating the length of air gap of thre phase induction motor. Why the air gaps should be as small as possible? **[8]**

b) Estimate the stator core dimensions, number of stator slots and number of stator conductors per slot for a 100 KW, 3300V, 50Hz, 12 pole star connected slip ring induction motor, assume: average gap density = 0.4 wb/m^2, conductors per metre = 25000A/m, efficiency = 0.9, power factor = 0.9, and winding factor = 0.96, choose main dimensions to give best power factor. Slot loading should not exeed 500 ampere conductors.**[8]**

OR

Q6) a) What is unbalanced magnetic pull in a three phase induction motor and explain procedure of its estimation. **[8]**

b) A 11KW, three phase, 6 poles, 50Hz, 220V, star connected induction motor has 54 stator slots, each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine has an efficiency of 0.86 and a power factor of 0.85. The rotor mmf may be assumed as 85 percent of stator mmf. Also find the bar and the end ring section if the current density is $5A/mm^2$. **[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. **[8]**

b) A 80KW, 2 pole machine with sinusoidal flux distribution has the following data, axial length of core = 0.25m, stator bore = 0.52m, length of air gap = 5mm, peak magnetizing mmf per pole = 4800 A, Calculate **[8]**

i) magnetic pull per pole when the rotor is symmetrical centered.

ii) UMP per pole if rotor axis is displaced by 0.8mm,

iii) ratio of UMP to useful force negleting saturation.

OR

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

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 = 11 slots. **[8]**

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