Total No. of Questions :8]

SEAT No. :

P2879

[Total No. of Pages :3

[4958]-1068

T.E. (Electrical Engineering)

DESIGN OF ELECTRICAL MACHINES

(2012 Course) (End - Semester) (303149) (Semester - II)

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) ***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) What are different types of winding used in a transformer? Explain any one. **[6]**

b) Derive the output equation of a three phase transformer with usual notation. **[6]**

c) A 200 KVA, 6600/400V, three phase transformer, delta/star connected, 50Hz, 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. **[8]**

OR

Q2) a) Discuss mechanical forces developed under short circuit condition in a transformer and measures to overcome this effect. **[6]**

b) Define and explain short time rating and continuous time rating. **[6]**

c) Calculate the percentage regulation at full load 0.8pf lag for a 300 kVA, 6600/440V, delta-star, three phase, 50Hz, core type transformer having cylindrical coils of equal length with the following data. Height of coils = 4.7cm, thickness of HV coil = 1.6 cm, thickness of LV coil = 2.5 cm, insulation between LV & HV coils = 1.4 cm, Mean diameter of the coils = 27 cm, volt/turns = 7.9 V, full load copper loss = 3.75 kW. **[8]**

P.T.O.

Q3) a) Discuss the various factors to be considered for selection specific magnetic loading (B_{av}) and specific electric loading (ac). **[10]**

b) 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]**

OR

Q4) a) Derive the output equation of a three phase induction motor in terms of its specific loadings. Also indicate the significance of terms involved.**[8]**

b) Estimate the main dimensions for three phase, 50Hz, 10kW, 400V, 4 pole squirrel cage induction motor. Assume full load efficiency of 0.85, full load power factor of 0.9 and winding factor 0.96. The specific magnetic loading is 0.6 Wb/m^2 and the specific electric loading = 22000A/m. Take rotor peripheral speed as 25 m/s at synchronous speed. **[10]**

Q5) a) Discuss the various factors which decide selection of number of stator slots in case of three phase induction motor. **[8]**

b) Explain the concept of 'Unbalance Magnetic Pull (UMP)' and its estimation. Why is UMP high when three phase induction motor is designed with small air gap? **[8]**

OR

Q6) a) Derive the equation for end ring current for the rotor of squirrel cage induction motor along with the necessary diagram. **[8]**

b) A 15kW, three phase, 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) Derive the equation for No Load Current of three phase induction motor. **[8]**

b) A 20 kW, three phase, 50Hz, 400V, 8 pole, star connected squirrel cage induction motor has magnetizing current of 30% of the full load current. Calculate the value of stator turns per phase, if the mmf required for the flux density at 60^{o} from pole axis is 600A. Assume full load efficiency as 0.9, full load power factor as 0.85 and winding factor as 0.955. **[8]**

OR

Q8) a) Explain the effect of ducts on the calculation of magnetizing current of three phase induction motor. **[8]**

b) Discuss the performance calculation of three phase induction motor from circle diagram. **[8]**

EEE