Total No. of Questions : 12] **SEAT No. :**

P1405 **[Total No. of Pages : 3**

[4858] - 168

T.E. (Electrical) (Semester - II)

DESIGN OF ELECTRICAL MACHINES

(2008 Pattern)

Time :3 Hours] ***[Max. Marks :100***

Instructions to the candidates:

1) ***Answer 3 questions from Section I and 3 questions from Section II.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Write note on magnetic leakage and state effects of magnetic leakage. **[8]**

b) Explain : **[8]**

i) Phenomenon of Rotating Hysterisis.

ii) Pulsation Loss.

OR

Q2) a) Explain Carter's fringe curve and gap distribution factor in detail. **[8]**

b) Explain principal components of leakage flux for poly-phase machines. **[8]**

Q3) a) Draw heating curve and cooling curve and explain the following : **[8]**

i) Heating time constant.

ii) Cooling time constant.

iii) Final steady temperature rise.

iv) Hot spot temperature.

b) Enlist specifications of transformer as per IS 2026. **[8]**

OR

P.T.O.

Q4) a) Derive output equation of single phase core type transformer. **[8]**

b) Determine the main dimensions of 500 KVA, 6600/400 V, 3 phase, 50 Hz core type oil immersed self-cooled distribution transformer. Voltage per turn is 20V, area factor for stepped core is 0.56, window space factor = 0.3, current density is 3A/mm^2, B_m = 1.2Wb/m^2, width of largest stamping = 0.85d, D = 1.85a. Assume $A_y = A_i$ **[8]**

Q5) a) Derive the formula for axial forces developed in transformers. **[8]**

b) Determine the main dimension of core and yoke for a 200 KVA, 50Hz, 1 phase, core type transformer. A cruciform core is used with distance between adjacent limbs is 1.5 times the width of core laminations. Assume voltage per turn = 14V, B_m = 1.2T, K_w = 0.30, current density = 2.5A/mm^2, K_s = 0.9, $A_i = 0.56d^2$. Width of largest stamping is 0.85d. **[10]**

OR

Q6) a) Discuss mechanical forces in transformer and explain how they are taken into consideration while fabricating and how the mechanical bracing is provided? **[8]**

b) A 500KVA11000/400delta/star transformer has following details : HV turns = 1660, length of mean turn = 93cm, length of coil = 52cm, short circuit current = 20 x rated current. Find radial force in tonnes on HV winding under short circuit conditions. **[10]**

SECTION - II

Q7) a) Define, (i) specific magnetic loading and (ii) specific electric loading. Explain the effect of the same on the size and the permance of induction motor if the values of specific magnetic loading and specific electrical loading are selected above the normal valves during the design of induction motor. **[10]**

b) Find the main dimensions of a 15kW, 3-phase, 400 V, 50 Hz, 2810 rpm SCIM having an efficiency of 0.88 and a full load power factor of 0.9

Assume -

Specific magnetic loading = 0.5 wb/m^2, specific electric loading = 25,000 A/m., The rotor peripheral speed 20 m/sec at synchronous speed. **[8]**

OR

Q8) a) Derive the equation for KVA input for 3-phase induction motor. **[8]**

b) Draw the winding diagram for three-phase, 24 slots, 4-pole, double layer type induction motor. **[10]**

Q9) a) Explain the harmonic synchronous torques produced in three-phase induction motor. due to harmonic field. **[6]**

b) Explain the effect of length of air-gap affect the overload capacity of induction motor. **[4]**

c) Explain the methods used to reduce harmonic torques in three - phase induction motor. **[6]**

OR

Q10) a) Explain the procedure for the design of rotor bars and slots. in squirrel cage induction motor. **[8]**

b) A 11 kW, 3-phase, 6-pole, 50 Hz, 220V, star connected induction motor has 54 slots, each containing 9 conductors, Calculate the value of bar and endring currents. The number of rotor bars is 64. The machine has efficiency of 0.86 and power factor of 0.85. The rotor mmt may be assumed as 85% of stator mmf. Also find the bar and the end-ring size if the current density is $5A/mm^2$. **[8]**

Q11) a) Explain the effect of dispersion coefficient on maximum power factor in pulyphase induction motor. **[8]**

b) Explain the factors on which the no-load current in 3-phase induction. **[8]**

OR

Q12) a) Explain the effect of dispersion coefficient on the power factor on an induction motor. **[8]**

b) Derive the equation for magnetising current per phase in three-phase induction motor. **[8]**