B.E. Sixth Semester (Electro. & Power. Elect. & Power, Electrical Engg.) (CGS)

10564 : Computer Aided Machine Design : 6 EP 04 / 6 EL 04 / 6 EE 04

P. Pages : 2 **AU - 2757**

Time : Three Hours Max. Marks : 80

Notes :
1. Due credit will be given to neatness and adequate dimensions.
2. Assume suitable data wherever necessary.
3. Diagrams and equations should be given wherever necessary.
4. Retain the construction lines.
5. Illustrate your answer necessary with the help of neat sketches.
6. Use of slide rule logarithmic tables, Drawing instrument and non programmable calculator is permitted.
7. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) Draw the flow charts of analysis method and synthesis method of design. Also compare them. **7**

b) Explain in detail the construction of a 3-phase transformer. **6**

OR

2. a) Explain the classification of insulating materials on the basis of their maximum permissible temperature. **7**

b) Differentiate between distribution transformer and power transformer. **6**

3. a) Explain in detail specific electric and magnetic loadings of a transformer. **5**

b) Calculate the core and window area of a 400 kVA, 50 Hz, single phase, core type power transformer. The following data may be assumed. **8**
Ratio of weight of iron to weight of copper = 4 ;
Ratio of length of mean turn of copper to length of mean flux path = 0.5 ;
maximum current density = 1.5 Wb/m^2 ; Current density = 2.2 A/mm^2 ;
density of copper = $8.9 \times 10^3 kg / m^3$,
density of iron = $7.8 \times 10^3 kg / m^3$; copper space factor = 0.12.

OR

4. a) Calculate and draw the main dimensions details of a 100 kVA, 2 kv/400V, 50 Hz, single phase shell type, oil immersed, self cooled transformer. Assume : **8**
Voltage per turn = 10V, Max. flux density in core = 1.1 Wb/m^2 ;
Current density = 2 A/mm^2 ; Window space factor = 0.33 ;
The ratio of window height to window width = 3
stray load loss = 10% of full load copper loss ; iron loss per kg for 1.5 Wb/m^2 = 1.23 W.
Assume an extra loss for joints = 20% of total iron loss.

b) Explain the design of core of transformer stepped type. **5**

5. a) Derive the equation for calculation of leakage reactance of core type transformer referred to primary side for concentric, cylindrical coils. **8**

b) Explain that the leakage reactance of core type transformer is reduced to nearly to one fourth by subdivision and interlacing of windings. **6**

OR

6. a) A single phase, 400V, 50 Hz, transformer is built from stampings having a relative permeability of 1000. The length of the flux path is 2.5 m, the area of cross section of the core is 2.5×10^{-3} m^2 and the primary winding has 800 turns. Estimate the maximum flux and no load current of the transformer, the iron loss at the working flux density is 2.6 W/kg. Iron weights = 7.8×10^3 kg/ m^3. Stacking factor is 0.9. **8**

b) Explain different cooling methods of transformer. **6**

SECTION - B

7. a) Explain in detail the factors that affects the choice of specific electric and magnetic loadings of induction motors. **6**

b) Determine the main dimensions, number of turns per phase, and number of stator slots of a 3.7 kw, 400 volts, 3 phase, 4 pole, 50 Hz squirrel cage induction motor to be started by a star/Delta starter. Assume : Average flux density in the gap = 0.45 Wb/m^2, Ampere conductors per meter = 23000, efficiency = 0.85, and power factor = 0.84. Choose the main dimensions for cheap design (Ratio of axial length to pole pitch = 1.5). Winding factor = 0.955, Stacking factor = 0.9. **7**

OR

8. a) With reference to design of stator of induction motor, explain : **6**
   i) Factors affecting selection of number of slots,
   ii) Size and shape of stator slots,
   iii) Minimum width of stator tooth.

b) Find the main dimensions of a 15 kw, 3 phase, 400 V, 50 Hz, 2810 r.p.m. squirrel cage induction motor 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 = 25000 A/m. Take the rotor peripheral speed as 20 m/s at synchronous speed. **7**

9. a) Explain in detail the design of rotor bars and slots. **7**

b) Obtain an expression for the end ring current in squirrel cage rotor. Also explain why current density in end ring can be chosen to be greater than that of bar. **7**

OR

10. a) Explain cogging and crawling in an induction motor. How to avoid these cogging and crawling ? **7**

b) Explain in detail design of wound rotor. **7**

11. a) Explain dispersion coefficient and its effect on maximum power factor and overload capacity. **7**

b) Derive the formula for squirrel cage rotor resistance per phase referred to stator side. **6**

OR

12. a) Explain the calculation of magnetizing current of an induction motor. **7**

b) Explain the effect of - **6**
   i) Change in number of poles, and
   ii) Change in frequency on the performance of induction motor.

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