B.E. / B.Tech. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-V

ELECPR1 / TE101A - Electrical Machine Design

P. Pages : 2 **GUG/S/25/13861**

Time : Three Hours * 2 2 9 6 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
6. Read the question paper carefully (Branch, Semester, Scheme) before attempting the questions.
7. Use of programmable calculator is prohibited.
8. Draw neat and proper diagram/sketches.
9. Don't use red pen for writing the answers.
10. Don't write any other comments except answers of questions.

1. a) What are the desirable properties of insulating materials? Explain the classification of insulating materials based on the thermal consideration with two examples of each. **8**

b) A single phase transformer when supplied with 220V, 50Hz has eddy current loss of 50w. If the transformer is connected to a voltage of 330V, 50Hz, the eddy current loss will be? **8**

OR

2. a) Discuss in detail about the materials used in the construction of electrical machines? **8**

b) Core loss of a machine is 50W at 50Hz and 75W at 70Hz. If both are measured at same flux density, calculate the hysteresis and eddy current loss at 60 Hz. **8**

3. a) Derive an expression for volts/turn of transformer. **8**

b) Write short note on: **8**

i) Need of stepped core.

ii) Comparison of distribution and power transformer

OR

4. a) Derive the output equation of single phase transformer. **8**

b) Explain tap changers and its necessity. **8**

5. a) Write about the resistance and leakage reactance of the transformer with phasor diagram. **8**

b) Design an adequate cooling arrangement for a 250 KVA, 6600/400 V, 50 Hz, 3 phase oil immersed transformer with following details. **8**

a) winding temperature rise not to exceed 50 degree c.
b) total losses at 90 degree c are 5 KW
c) tank dimensions i.e. height *length* width = 125 *100* 50 (all in cm)
d) oil level = 115 cm length

OR

6. a) Discuss in detail about the design of cooling tanks. **8**

b) Explain different methods of cooling of transformer. **8**

7. a) Derive the output equation of induction motor. **8**

b) Find the main dimensions, number of stator turns, size of conductor and number of stator slots of a 5 h.p., 400 V, 3-phase, 4-pole squirrel cage induction motor using star-delta starter running at a synchronous speed of 1500 rpm. Assume the following data: **8**
Average flux density in the air gap = 0.46 Wb/m2
Ampere conductors per meter of armature periphery = 22 x 103
Full load efficiency – 83%
Full load p.f. = 0.84 lagging
Winding factor = 0.955
Stacking factor = 0.9
Current density = 4A/mm2
No. of slots per poles per phase = 3
L/t = 1.5

OR

8. a) Write in detail about the design of stator windings and stator slots. **8**

b) In the design of a 30 h.p., 3 ph, 440V, 960 rpm, 50Hz delta connected induction motor, assume the specific electric loading of 25000 ac/m, specific magnetic loading = 0.46 wb/m2. Full load efficiency 86%, p.f. 0.87 and estimate the following: **8**

i) stator core dimensions
ii) number of stator slots and winding turns.

9. a) Write a short note on : Ventilation of synchronous generator. **8**

b) Explain how the quantity of air required to absorb losses of electrical machines is determined. **8**

OR

10. a) Write a short note on: **8**

i) Direct cooling of turbo alternator.

ii) Cooling air circuit

b) Write about the field coil design for salient pole machine and for turbo generator rotor. **8**

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