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

ELECPR1 / TE101A - Electrical Machine Design

P. Pages : 2 **GUG/W/24/13861**

Time : Three Hours * 5 4 9 7 * 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. Every question has equal weightage.
8. Use of programmable calculator is prohibited.
9. Draw neat and proper diagram/sketches.
10. Don't use red pen for writing the answers.
11. Don't write any other comments except answers of questions.

1. a) Core loss of a machine is 70W at 40Hz and 95W at 55Hz. If both are measured at same flux density, calculate the hysteresis and eddy current loss at 60Hz. **8**

b) Explain the ratings and specifications used for the electrical machines. **8**

OR

2. a) A single phase transformer when supplied with 440V, 50Hz has eddy current loss of 60w. If the transformer is connected to a voltage of 660v, 50Hz, the eddy current loss will be? **8**

b) Explain the calculations used for the losses in the electrical machines. **8**

3. a) Explain different types of transformer? **8**

b) Derive an expression for output equation for 3 phase transformer. **8**

OR

4. a) Write short note on- **8**
i) Off load tap Changer ii) Need of stepped core

b) Write in brief about- **8**
i) Window space factor ii) Specific loading of the transformer

5. a) Explain different methods of cooling of transformer. **8**

b) Write about the resistance and leakage reactance of the transformer. **8**

OR

6. a) Design an adequate cooling arrangement for a 250KVA, 6600/400V, 50Hz, 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 5KW
c) Tank dimensions i.e. height * length * width = 125 * 100 * 50 (all in cm)
d) Oil level = 115 cm length

b) Discuss in detail about- **8**

i) Voltage regulation ii) Design of tank with tubes

7. a) In the design of a 30 h.p., 3 ph, 440V 960 rpm, 50 Hz delta connected induction motor, assume the specific electric loading of 25,000 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

b) Derive the output equation of induction motor. **8**

OR

8. a) Find the main dimensions, number of stator turns, size of conductor and number of stator slots of a 5 h.p., 400V, 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 = 4 A/mm2
No. of slots per poles per phase = 3
L/t = 1.5

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

9. a) Write a short note on- **8**

i) Direct cooling of turbo alternator ii) Cooling air circuit

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

OR

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

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

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