

B.E. Electrical (Electronics & Power) Engineering (Model Curriculum) Sem-V
TE101A / PEC-EE01 : Electrical Machine Design

P. Pages : 2

Time : Three Hours



GUG/W/22/13861

Max. Marks : 80

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

1. a) What are the major considerations accounted for the good design of electrical machines. **8**
- b) A single phase transformer when supplied with 440V, 55 Hz has eddy current loss of 55W. If the transformer is connected to a voltage of 520V, 65 Hz, the eddy current loss will be? **8**

OR

2. a) Core loss of a machine is 60 W at 60 Hz and 80 W at 70 Hz. If both are measured at same flux density, calculate the hysteresis and eddy current loss at 50 Hz. **8**
- b) 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**
3. a) Derive the output equation of three phase transformer. **8**
- b) Derive an expression for volts/turn of transformer. **8**

OR

4. a) Derive the output equation of single phase transformer. **8**
- b) Write short note on : **8**
 - i) Need of stepped core.
 - ii) Comparison of distribution and power transformer.
 - iii) Necessity of tap changers.
5. a) Write in short about the voltage regulation? **8**

- b) Design an adequate cooling arrangement for a 250 KVA, 6600/400V, 50 Hz. 3 phase oil immersed transformer with following details. **8**
- Winding temperature rise not to exceed 50 degree C.
 - Total losses at 90 degree C are 5 kW.
 - Tank dimensions i.e height * length * width = 125 * 100 * 50 (all in cm).
 - Oil level = 115 cm length.

OR

6. a) Write about the resistance and leakage reactance of the transformer. **8**
- b) Discuss in detail about the design of cooling tanks. **8**
7. a) Write in detail about the design of stator windings and stator slots. **8**
- 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., 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 = 4 A/mm²
 No. of slots per poles per phase = 3
 L/t = 1.5
- b) In the design of a 30 h.p. 3 ph, 440 V, 960 rpm, 50 Hz 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**
- Stator core dimensions
 - Number of stator slots and winding turns.
9. a) Write a short note on: Ventilation of synchronous generator. **8**
- b) Write a short note on: **8**
- Direct cooling of turbo alternator
 - Cooling air circuit.

OR

10. a) Write about the field coil design for salient pole machine and for turbo generator rotor. **8**
- b) Explain how the quantity of air required to absorb losses of electrical machines is determined. **8**
