Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(EE) (Sem.–6)

COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Subject Code : BTEE-605A

M.Code : 71152

Date of Examination : 12-07-22

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a) Define specific electric loading stating it mathematical formula.

b) Give two examples of class Y insulating materials and write the temperature they can withstand.

c) Write the advantages of analysis approach over synthesis approach in computer aided design.

d) Write the empirical formula used for obtaining the air-gap for a 3 phase induction machine stating clearly the terms used.

e) Discuss the choice of 'k' for different types of transformers.

f) Why CRGO steel cannot be used in small rotating machines?

g) What are the factors to be considered for the choice of magnetic loading in case of transformers?

h) Differentiate between fringing and leakage flux.

i) Discuss the choice of current density in the design of induction machines.

j) Explain the need of leakage coefficient in the design of magnetic circuit.

SECTION-B

2. Derive the output equation of a 3-phase core type transformer.

3. A slip ring induction motor of 100 kW, 3300 V, 50 Hz, 12 poles with star connected winding is to be designed to give the best power factor. Estimate the main dimensions assuming the following data for design.

   B_{av} = 0.4 T, ac = 25,000 ac/m, efficiency = 90%, power factor = 0.9 (lag), winding factor=0.96.

4. Obtain the overall dimensions for a single phase transformer. Use suitable diagram to support your answer. Assume rectangular core.

5. The initial temperature rise of a transformer is 26° C. After two hours operation on full load it is 56°C and after four hours run it is 71° C.

   a) Calculate the maximum final temperature with full load on the transformer.

   b) Estimate the heating time constant.

   c) How much time will it take after start for the transformer to reach $(5/6)^{th}$ of its final steady state temperature?

6. Determine the relevant equations to design the cooling tube for a transformer. Write also, the suitable assumptions made for the calculation.

SECTION-C

7. When a motor runs at its continuous rating, its final temperature rise is 75 C. The machine has a heating time constant of 0.75 hours.

   a) Calculate the temperature after one hour of the start of the motor and running continuously on load

   b) Calculate the maximum steady state temperature, if the temperature rise in one hour rating is 75°C.

   c) How much time will the motor take to rise from 50°C to 75°C if it is working at its one hour rating?

8. Determine the main dimensions of the core, the number of turns and the cross-section of the conductors for a 5 kVA, 11000/400 V, 50 Hz, single-phase core-type distribution transformer. The net conductor area in the window is 0.6 times the net cross-section of iron in the core. Assume a square cross-section for the core, a flux density 1 Wb/m^2, a current density $1.4A/mm^2$, and a window space factor 0.2. The height of window is 3times its width.

9. Find the main dimensions, number of tups per phase, number of stator slots and conductors of a 15 kW, three-phase, 2-pole, 400 V, 50 Hz, 2810 rpm, 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 T, specific electric loading = 25,000 ac/m. Take the rotor peripheral speed approximately as 20 m/s. Use star delta starting.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.