G 6419

M.E. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

Power Electronics and Drives

PE 1651 — COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS

(Regulations 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List two limitations of conventional design procedure for electrical apparatus.

2. What are the main aims of a designer?

3. Define magnetic vector potential.

4. Write the electromagnetic field equations in terms of $\overline{E}$.

5. What are shape functions?

6. Define discretization in FEM analysis.

7. Define Meshing.

8. Name few elements of a CAD system.

9. Write the design equation for induction motor.

10. Mention the emf equation of a power transformer.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Write about any two conventional design procedures for electrical apparatus. (8)

(ii) Explain how will you design a three phase induction motor using one of the procedures in Qn. 11. (a). (8)

Or

(b) (i) List some assumptions made in design of electrical apparatus. (4)

(ii) Write the design equations for a DC machine. Derive one of them. (8)

(iii) Write the need for field analysis based design. (4)

12. (a) (i) Differentiate between magnetic scalar and vector potentials. (8)

(ii) Derive the electromagnetic field equations. (8)

Or

(b) (i) Write about use of poisson's and Laplace equations in mathematical formulation of field problems. (8)

(ii) Discuss about

(1) energy functional (2) stored energy in field problems. (8)

13. (a) (i) Compare finite difference and finite element methods. (10)

(ii) How is discretization done in FEM? (6)

Or

(b) (i) Discuss the role of shape functions and stiffness matrix in FEM. (10)

(ii) How is energy minimization done in FEM? (6)

14. (a) (i) Do boundary conditions affect the nature of design. If so how? (4)

(ii) Explain how preprocessing and post processing are carried out in CAD of electrical apparatus. (8)

(iii) How will you incorporate material properties in CAD of electrical apparatus? (4)

Or

(b) Using a common CAD package, write in detail stepwise, the design of any one electrical apparatus. (16)

15. (a) Discuss in detail the design of any one type of insulators. (16)

Or

(b) Write in detail, the design of solenoid actuator. (16)