

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING
SEMESTER	2
COURSE TITLE	COMPUTER AIDED DESIGN OF ELECTRIC MACHINES
COURSE CODE	01EV1205
COURSE CREDITS	4

Objective:

- 1 Main objective of subject is to prepare computer based design of motors to be used for Electrical Vehicles.

Course Outcomes: After completion of this course, student will be able to:

- 1 To introduce the importance of computer aided design method.
- 2 Implement equations in software program.
- 3 Create software-based design of DC Motor, Induction Motor & Special Electric Motor.
- 4 Analysis of machine part with FEM.
- 5 Prepare GUI for design of electrical machines.

Pre-requisite of course: Design of Electrical Machines

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	CONCEPT OF COMPUTER-AIDED DESIGN AND OPTIMIZATION Introduction; Computer Aided Design; Explanation of details of flow chart, Input data to be fed into the program; Applicable constraints Max or Minimum permissible limits, Output data to be printed after execution of program, Various objective parameters for optimization in an electrical machine, Selection of optimal design, Explanation of lowest cost and significance of "Kg/KVA", Flowcharts.	8

Contents : Unit	Topics	Contact Hours
2	BASIC CONCEPTS OF DESIGN Introduction; Specification; Output coefficient; Importance of specific loadings, Electrical Materials: Conducting Materials, Insulating Materials and Magnetic Materials, Magnetic circuit calculations; General procedure for calculation of Amp- Turns, Heating and Cooling; Modes of heat dissipation; Standard ratings of Electrical machines, Ventilation in rotating machines; Quantity of cooling medium, Types of enclosures; General design procedure; Steps to get optimal design	6
3	APPLICATION OF FINITE ELEMENT METHOD IN DESIGN Introduction; Basics of Finite element, Shape functions, Single element computation. Assembly of elemental coefficient matrix, Global coefficient matrix, Application of FEM technique for design problems. Use of open source FEM software for 2D design. Computation of Capacitance of capacitor, cable, multi dielectric cable through FEM, Computation of electrostatic field for various geometry, skin and proximity effect in conductors	3
4	COMPUTER AIDED DESIGN OF INDUCTION MOTOR Introduction; Flowcharts and programs for computer aided design of Induction motor, 2D FEM open source software-based Induction motor part design	6
5	COMPUTER AIDED DESIGN OF DC MACHINES Introduction; Flowcharts and programs for computer aided design of DC machines, 2D FEM open source software-based DC machine part design	12
6	COMPUTER AIDED DESIGN OF BLDC, SRM and PMSM motors COMPUTER AIDED DESIGN OF BLDC, SRM motors, PMSM motors	7
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment No. 01 Introduction to CAD Software for Electrical Machine Design	2
2	Experiment No. 02 Design of an Electrical Machine (Motor or Transformer) Using CAD Tools	2
3	Experiment No. 03 Thermal Analysis of Electrical Machine Design Using CAD	4
4	Experiment No. 04 Finite Element Analysis (FEA) for Structural Integrity of Electrical Machines	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
5	Experiment No. 05 Optimization of Electrical Machine Design for Efficiency	2
6	Experiment No. 06 Simulation of Electrical Characteristics of Machines (e.g., Induction Motor or Transformer)	2
7	Experiment No. 07 Load Analysis and Load Flow Calculation for Electrical Machines	4
8	Experiment No. 08 Efficiency vs. Weight Optimization in Electrical Machines (Kg/KVA)	2
Total Hours		20

Textbook :

- 1 Computer aided design of electrical machines., K M Vishnu Murthy,, B S Publications, NA
- 2 Computer- Aided Design of Electrical Equipment., Dr. M. Ramamoorthy., East-West press Pvt. Ltd. New Delhi., NA
- 3 Computer aided design of electrical machines, Maurya, Jallan, Shukla, Kataria publication, -
- 4 Permanent Magnet Synchronous and Brushless DC Motor Drives, Ramu Krishnan, CRC Press, -
- 5 Finite Element Analysis of Electrical Machines, S.J Salon, Springer, Yes DEE publishers, 2007
- 6 Electrical Machine Analysis using Finite Elements, Nicola Bianchi, CRC Taylor & Francis, 2005

References:

- 1 Principles of Electrical Machine Design with Computer Programmes., Principles of Electrical Machine Design with Computer Programmes., S.K. Sen, Oxford & IBH Publishing Co., -
- 2 Computer aided design of FHP motors, Computer aided design of FHP motors, C.G. Veinott, McGraw Hill Pub. Co., -

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
5.00	10.00	15.00	30.00	20.00	20.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc24_ee50/preview
- 2 <https://enine.digimat.in/nptel/courses/video/108102372/L39.html>