

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Engineering
Name of Programme:	B. Tech. in Electrical Engineering
Semester:	VII
Course Code:	4EE104DE25
Course Title:	Computer Aided Design of Vehicular Motors
Course Type:	Disciplinary Minor - (Elective Course-II)
Year of Introduction:	2025 – 26

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to -

1. apply computer aided design and finite element analysis (BL3)
2. select appropriate material for vehicular motor design (BL4)
3. design vehicular motors (BL6)
4. validate the performance of vehicular motors with CAD. (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit-I	Computer Aided Design Introduction, limitations of conventional design, features of computer aided design, various approaches in computer aided design, selection of input data and design variables, optimization of design.	06
Unit-II	Finite Element Analysis Introduction, objectives of the Finite Element Analysis (FEA), features of FEA, steps involved in FE analysis: Preprocessing, Solution & Post Processing, mesh generation, boundary conditions, two-dimensional (2D) and three-dimensional (3D) FE problems, static analysis, time-varying analysis, and motion analysis	08
Unit-III	CAD of Three-Phase Induction Motor Introduction, selection of various design variables, choice of materials, calculation of main dimensions, stator design, rotor design, performance estimation, flow chart for CAD of three-phase induction motor, computerization of design procedure, various grades of core materials, parametric analysis, and performance improvement, application of FE packages for design analysis, case studies & discussion for vehicular applications	10
Unit-IV	CAD of Permanent Magnet Brushless DC Motor Introduction, selection of various design variables, choice of materials, calculation of main dimensions, stator design, rotor design, performance estimation, flow chart for CAD of PMBLDC motor, computerization of design procedure, various grades of permanent	11

magnets, parametric analysis, factors to be considered for high speed designs, performance improvement, application of FE packages for design analysis, case studies & discussion for vehicular applications

Unit-V CAD of Switched Reluctance Motor

10

Introduction, selection of various design variables, choice of materials, calculation of main dimensions, stator design, rotor design, performance estimation, flow chart for CAD of switched reluctance motor, computerization of design procedure, parametric analysis, factors to be considered for high speed designs, performance improvement, application of FE packages for design analysis, case studies & discussion for vehicular applications

Self-Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial Work:

This shall consist of at least 06 tutorials based on the above syllabus.

Suggested Readings:

1. Silvester and Ferrari, *Finite Elements Methods for Electrical Engineers*, Cambridge University Press.
2. Bianchi Nicola, *Electrical Machine analysis using Finite Elements*, CRC Press.
3. M. G. Say, *Performance and Design of Electrical Machines*, John Wiley and Sons.
4. S. K. Sen, *Principles of Electrical Machine Design With Computer Programmes*, Oxford & IBH.
5. A. K. Sawhney, *A Course in Electrical Machine Design*, Dhanpat Rai and Sons.
6. D. C. Hanselman, *Brushless Permanent Magnet Motor Design*, McGraw Hill.
7. R. Handershot and T. J. E. Miller, *Design of Brushless Permanent Magnet Motors*, Oxford, U.K.
8. Jacek F. Gieras, *Permanent Magnet Motor Technology: Design and Applications*, CRC Press.
9. R. Krishnan, *Switched Reluctance Motor Drives*, CRC Press.
10. Recent research papers from reputed journals.