# COURSE DESCRIPTION CARD - SYLLABUS

Course name
PO2: Computerization of design and simulation - Computer methods in design and simulation

## Course

Field of study
Electromobility

Year/Semester
2/4

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

## Number of hours

| Lecture | Laboratory classes | Other (e.g. online) |
|---|---|---|
| 15 | 15 | |
| Tutorials | Projects/seminars | |

## Number of credit points

2

## Lecturers

Responsible for the course/lecturer:
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Wydział Automatyki, Robotyki i Elektrotechniki
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Responsible for the course/lecturer:
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## Prerequisites

The student starting this course should have basic knowledge of the theory of electric circuits, control, computer science and numerical methods.

The student starting this course should have knowledge of the construction and principles of operation of electrical mechatronics devices and systems.

## Course objective

Acquiring the ability to create circuit models of selected mechatronic systems. Acquisition of numerical skills of solving coupled equations of electrical circuits and equations of mechanical equilibrium. Getting to know the computing capabilities of selected commercial programs.

## Course-related learning outcomes

Knowledge

1. The student has knowledge of IT issues of key importance for the electromobility area.

2. The student has knowledge of programming and the use of IT tools in modeling, simulation and design.

Skills

1. The student can write and use programs used for the design, analysis, simulation and control of mechatronic devices.

2. The student is able to formulate and solve engineering tasks in the field of electromobility, can use known mathematical models and algorithms as well as simulation, experimental and analytical methods.

Social competences

1. The student is aware that knowledge and skills in the field of electromobility are evolving rapidly.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory: rewarding practical knowledge gained during previous laboratory exercises, checking practical programming skills (final test), assessment of knowledge and skills related to the implementation of individual and group programming projects.

Obtaining additional points for activity during classes, especially for: the ability to cooperate as part of a team practically carrying out a detailed task in the laboratory, the use of elements and techniques that go beyond the material of the lecture and laboratory exercises, aesthetic diligence of completed projects.

## Programme content

Electromagnetic and electromechanical converters used in electric vehicles. Classification of mathematical models of electromechanical converters. General description of circuit models. Equations of electric circuits of converters. Dynamics equations of electromechanical systems. Mathematical models of electromechanical converters and complex mechatronic systems used in electromobility. Methods of solving differential equations describing the state of the system. Methods for solving nonlinear difference equations. Computer methods of calculating the magnetic field distribution in electromagnetic converters. Steady-state and dynamic simulation algorithms for electromechanical converters used in electric vehicle drives. Basic principles of design and optimization of electromechanical converters. The use of publicly available Python libraries, MatLab-Simulink and Ansoft Maxwell software to analyze the operating states of selected electromechanical converters used in electromobility.

## Teaching methods

Laboratory: performing laboratory exercises in teams under the supervision of the teacher.

## Bibliography

Basic

1. B. Mrozek, Z. Mrozek, MATLAB i Simulink, W Helion, Gliwice, 2004.

2. R. Burden, J.D. Faires, Numerical Analysis, PWS Publishers, Prindle, Weber&Schmidt, 1985.

3. P. Krauze, Analysis of Electric Machinery, McGraw Hill Book Company, New York 1986.

4. M. Sobierajski, M. Łabuzek, Programowanie w Matlabie dla elektryków, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2005.

Additional

1. B. Baron, Metody Numeryczne w Turbo Pascalu, HELION, Gliwice 1995.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 50 | 2,0 |
| Classes requiring direct contact with the teacher | 30 | 1,5 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 20 | 0,5 |

[1] delete or add other activities as appropriate