COURSE DESCRIPTION CARD - SYLLABUS

Course name
Data analysis and visualization [S2Elmob1-SPE>AiWD]

Course

Field of study
Electromobility

Year/Semester
1/2

Area of study (specialization)
Energy Processing Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student starting this course should have a basic knowledge of computer science and numerical methods. The student starting this course should have a basic knowledge of the measurement of electrical and non-electrical electromagnetic devices.

Course objective

Acquainting with the basic issues and concepts related to the analysis and visualization of data in the field of electrical engineering. Acquiring basic skills necessary for the analysis and processing of measurement signals and their interpretation. Acquiring the ability to use selected computational packages for the analysis and visualization of measurement data. Acquiring the ability to create software that enables data analysis, interpretation and visualization.

Course-related learning outcomes

Knowledge:

1. The student has extensive knowledge in the field of programming techniques and the use of modern IT tools for the analysis and synthesis of electric systems of hybrid and electric vehicles, including traction ones.
2. The student has a theoretically based knowledge of modern methods of data collection, processing and analysis, also in the field of machine learning
3. The student has extensive knowledge in the field of measurements of electrical quantities and selected non-electrical quantities also with the use of remotely controlled systems; has in-depth knowledge of the development of experimental results.

Skills:
1. The student is able to use modern information and communication tools, advanced programming techniques and machine learning methods when collecting, processing and analyzing data.
2. The student is able to formulate and test hypotheses related to complex engineering problems and simple research problems in the field of electromobility, as well as to interpret the obtained results and draw critical conclusions.
3. The student is able to plan and carry out experiments involving computer simulations and measurements of electrical and non-electrical quantities in electric and hybrid vehicle systems and their charging infrastructure.
4. When determining the functionality and designing systems and systems of electric vehicles, the student is able to apply adequate analytical, simulation and experimental methods, evaluating their usefulness and limitations in advance, and adapting them to the specificity of the problem or the need to take into account unpredictable working conditions.

Social competences:
1. The student is aware of the importance of the latest scientific and technical achievements in solving research and practical problems and, if necessary, supporting himself with expert opinions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: credit on the basis of a test consisting of general and test questions. Rating scale 51-60% points satisfactory, 61-70% points satisfactory+, 71-80% points good, 81-90% points good +, 91-100% points very good.
Laboratory: rewarding practical knowledge gained during previous laboratory exercises, checking practical programming skills in Python (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

The aim of the course is to acquire skills in data analysis and visualisation. In the laboratory exercises carried out, basic Python libraries will be used, while the input data will be the results of measurements. The outcome will be the presentation of measurement results and analysis results.

Course topics

Python programming basics, Anaconda system support. Basic Python libraries: NumPy, pandas, Matplotlib, SciPy, Scikit-learn. Data structures, reading and writing data, file formats. Support for arrays and vectors. Operations of joining, binding and transforming data. Charts and data visualization, charts: bar, line, point. Data aggregation and operations performed on groups. Examples of measurement data analysis in the time domain as well as frequency domain.

Teaching methods

Lecture: presentation of issues with the use of multimedia, examples (e.g. computational) given on the blackboard, discussion on problem issues.
Laboratory: performing laboratory exercises in teams under the supervision of the teacher.

Bibliography

Basic:
1. W. McKinney, Python w analizie danych. Przetwarzanie danych za pomocą pakietów Pandas i NumPy oraz środowiska IPython. Wydanie II, Helion, 2018
2. W. McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, William McKinney, 2018
3. M. Gągolewski, A. Cena, M. Bartoszuk :Przetwarzanie i analiza danych w języku Python, Wydawnictwo Naukowe PWN, 2016
4. J. Grus, Data science od podstaw. Analiza danych w Pythonie. Wydanie II, Helion, 2020
5. J. Grus, Data Science from Scratch: First Principles with Python, 2nd Edition, O'Reilly Media, 2019
6. T. P. Zieliński, Cyfrowe przetwarzanie sygnałów. WKŁ Warszawa 2005
7. A. Biernat: Analiza sygnałów diagnostycznych maszyn elektrycznych, Politechnika Warszawska, 2015

Additional:
1. M. Krauss, E. Woschni, Systemy pomiarowo-informacyjne PWN Warszawa 1979

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00