COURSE DESCRIPTION CARD - SYLLABUS

Course name
Power electronic systems in electromobility [S2Elmob1>SEwE2]

Course

Field of study
Electromobility

Year/Semester
2/3

Area of study (specialization)
Alternative Fuels and Energy Storage

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
0

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge - Basic knowledge in the field of electrical engineering, electronics and power electronics. Skills - The ability to effectively self-educate in the field related to the chosen field of study; the ability to make the right decisions when solving simple tasks and formulating problems in the field of broadly understood electrical engineering. Competences - The student is aware of expanding his competences, shows readiness to work in a team, the ability to comply with the rules applicable during lectures and laboratory classes.

Course objective

Learning the properties and basic characteristics of converters dedicated to powering electric traction. Familiarization with broadly understood systems enabling bidirectional flow of electricity. Getting to know the solutions used in DC fast charging stations. Familiarization with dedicated drive converters. Discussion of systems cooperating with various types of electricity storage.

Course-related learning outcomes

Knowledge:
1. The student should have knowledge about the construction, operation and properties of modern

power electronic systems used in electromobility.
2. The student should have knowledge of the impact of converter systems on the power grid and know the selected methods of increasing the efficiency of electricity conversion in these systems.
3. The student should have knowledge of converter systems cooperating with electricity storage.

Skills:
1. The student should have knowledge about the construction, operation and properties of modern power electronic systems used in electromobility.
2. The student should have knowledge of the impact of converter systems on the power grid and know the selected methods of increasing the efficiency of electricity conversion in these systems.
3. The student should have knowledge of converter systems cooperating with electricity storage.

Social competences:
1. The student understands the importance of knowledge in solving problems and improving professional, personal and social competences.
2. The student is aware that in technology knowledge and skills become obsolete very quickly.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory:
Exercise reports. Passing threshold: 50%.

Programme content

Simulation models and physical models of high-current and control circuits for selected power electronic systems, examination of simulation and physical models, implementation of converter control algorithms.

Course topics

Research on advanced power electronic converters: traction power systems with PFC function, 3-phase controlled rectifiers and 6-phase uncontrolled rectifiers, systems enabling the storage of electricity obtained from electric vehicles, battery chargers, converter systems enabling the return of energy to the alternating voltage grid from various DC storages type, converter systems enabling operation in off-grid mode using DC storage, dedicated drive converters for electric vehicles (DC intermediary circuits and output circuits supplying the electric motor of a given type, structures enabling regenerative braking), active and passive BMS systems.

Teaching methods

1. Continuous assessment, rewarding the growth of skills in using the learned principles and methods.
2. Assessment of knowledge and skills related to the exercise, assessment of the exercise report.

Bibliography

Basic:
1. Mohan N., Undeland N., Robins W., Power Electronics, Jon Wiley & Sons Inc., New York 1999.
2. Strzelecki R., Supronowicz H., Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.
3. D. Kishan, R. Kannan, B. Reddy, P. Prajov, Power electronics for electric vehicles and energy storage, 2023.
4. M. Werner, The electric vehicle conversion handbook, H.P.Books, U.S., 2011.
5. L. A.Kumar, S. A. Alexander, Power converters for electric vehicles, CRC Press, 2020.
6. D. Andrea, Battery management systems for large lithium-ion battery, Artech House Publisher, 2010.

Additional:
1. Kaźmierkowski M., Krishnan R., Blaabjerg H., Control in Power Electronics, Academic Press, Amsterdam 2002.
2. S. Davis, Reading about electric vehicle design, 2023.

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