COURSE DESCRIPTION CARD - SYLLABUS

Course name

Electrical energy storages and energy consumption of vehicles

Course

Field of study

Electromobility

Year/Semester

3/5

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

compulsory

Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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tel. 61 665 23 89

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Responsible for the course/lecturer:

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Prerequisites

Basic knowledge of electrical engineering, electrical machines, and forms and methods of energy conversion. Ability to interpret transmitted messages and effective education in the field related to energy storage and hybrid systems as well as teamwork. Ability to use IT tools needed for modeling (e.g. Matlab, Visual Studio C #)

Course objective

Providing students with knowledge related to the construction, application and modeling of energy storage systems. Acquiring the skills to solve engineering problems requiring the selection of the type and parameters of energy storage in electric and hybrid vehicles.

Course-related learning outcomes

Knowledge

Has structured knowledge about energy storage technology and the types and principles of operation of various types of storage.Has knowledge of modeling techniques for selected electricity storage.

Skills

Is able to classify and analyze the work of energy storage and selected hybrid systems.

He can choose the type and parameters of energy storage for an electric vehicle.

Is able to select and model the work of selected energy storage in motor vehicles.

Social competences

Is aware of the growing problem of global pollution and the need to protect nature.Understand various aspects and effects of electrical engineer activities, including environmental impact.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired as part of the lecture is verified during the written test, which takes place during the last lecture. The exam consists of open-ended questions, scored according to the level of difficulty. Passing threshold: 50% of points. Final issues are sent by e-mail to the group staroste using the university e-mail system 2-3 weeks before the date of passing.

Programme content

Pro-ecological solutions in combustion vehicles. Standard vehicle driving cycles. Ecology in combustion vehicles. Parameters characterizing electricity storage and their durability. Analysis of the demand for power and energy of motor vehicles. Advanced work models of selected energy storage (modeling of lead-acid, lithium-ion batteries, supercapacitors, fuel cells) used in vehicles. Estimation of parameters of battery models and supercapacitors. Modeling of electrochemical durability (PbO2, Li-Ion) energy storage.

Teaching methods

Lecture: multimedia presentation, illustrated with examples given on the board, initiating discussions during the lecture. Additional materials placed in the Moodle system.

Bibliography

Basic

1. Leszek Kasprzyk, Wybrane zagadnienia modelowania ogniw elektrochemicznych i superkondensatorów w pojazdach elektrycznych, Poznan University of Technology Academic Journals. Electrical Engineering - 2019, Issue 101, s. 3-55.

2. Jastrzębska G.: Odnawialne źródła energii i pojazdy proekologiczne, WNT, Warszawa 2009.

3. Fuchs G., Lunz B., Leuthold M., Sauer D. U.: Technology Overview on Electricity Storage, RWTH Aachen, 2012.

Additional

1. Akumulatory elektryczne - Terminologia PN-88/E-01004 Polski Komitet Normalizacji Miar i Jakości.

2. Andrzej Czerwiński, Akumulatory, baterie, ogniwa. Wydawnictwa Komunikacji i Łączności, Warszawa, 2012.

3. Hariharan Krishnan S., Piyush Tagade, Sanoop Ramachandran. Mathematical Modeling of Lithium Batteries: From Electrochemical Models to State Estimator Algorithms. Springer, 2017

4. Akumulatory do napędu pojazdów elektrycznych drogowych - Część 3: Badania dotyczące działania i trwałości (kompatybilne w ruchu kołowym pojazdy do ruchu miejskiego) PN-EN 61982-3 / Polski Komitet Normalizacyjny

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for classes, preparation for tests/exam) [1]	30	1,0

[1] delete or add other activities as appropriate