COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrochemical electricity storage

Course

Field of study
Electrical power engineering

Year/Semester
1/2

Area of study (specialization)
Renewable sources and storage of energy

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
D.Sc. Ph.D. Leszek Kasprzyk, university prof.

Institute of Electrical Engineering and Electronics

leszek.kasprzyk@put.poznan.pl

tel. +48 61 665 23 89

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of electrical engineering, electrical machines as well as forms and methods of energy conversion. The ability to interpret the transmitted messages and effective education in the field related to energy storage and hybrid systems as well as work in a team.

Course objective

Acquainting students with the current state and directions of development of electrochemical energy storage in Poland and in the world. Presentation of the classification and characteristics of electrochemical electricity storage facilities and the presentation of selected methods of their testing and fastening.

Course-related learning outcomes

Knowledge

Knowledge of electrochemical electricity storage.

Knowledge of designing simple systems that work with electrochemical electricity storage

Skills

Can classify and analyze the operation of electrochemical electricity storage.

Is able to research, analyze and model the operation of electrochemical electricity storage facilities used.

Social competences

Aware of the growing energy problem in the world.

Understands the various aspects and effects of an electrical engineer's activity, including environmental impact.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified during the written test, which takes place at the last lecture. Passing consists of open-ended questions, depending on the difficulty level. Passing threshold: 50% of points. Passing issues are sent to the starost of the group by e-mail using the university's e-mail system 2-3 weeks before the deadline.

Passing laboratory exercises is based on the assessment of theoretical and practical knowledge necessary to perform the task, verified on an ongoing basis during classes with students and on the basis of written reports on the task performed.

Programme content

Lecture: Construction and principle of operation and modeling methods: electrochemical cells, supercapacitors, fuel cells. Operating parameters. Methods of selecting energy storage for a load with given characteristics. Modeling methods for electrochemical energy storage. Energy storage operation supervision systems (BMS). Durability of energy storage. Uninterruptible power supply systems, scalability of power and backup time, practical evaluation of parameters and functionality of power systems; redundant structures, alternative power supply systems (power generators and their cooperation with UPS and mains). Energy processing and energy storage management system.

Laboratories: Experimental study of selected electrical and operating parameters of electrical batteries and supercapacitors. Experimental determination of the characteristic parameters of energy storages. Analysis of the operation of electrochemical cells operating in a package using the battery management system (BMS). Modelling the operation of batteries and supercapacitors in dynamic states. Analysis of the operation of the hybrid energy storage system operating in the states of dynamically variable load.

Teaching methods

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

Laboratory: implementation of laboratory exercises at dedicated positions under the supervision of the instructor, demonstrations, discussions, work in teams.

Bibliography

Basic

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

2. 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.

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. 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

5. Denton T.: Automobile electrical and electronic systems, Arnold, London 2000.

6. Larminie J., Lowry J.: Electric vehicle technology. Explained, Wiley, West Sussex 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	56	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, reports preparation, project preparation, preparation of final essay, preparation for test) [1]	26	1,0

[1] delete or add other activities as appropriate