COURSE DESCRIPTION CARD - SYLLABUS

Course name
Renewable energy sources [S1Elmob1>OŹE2]

Course

Field of study
Electromobility

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of mathematics, physics and electrical engineering as well as renewable energy sources. Awareness of the need to expand one's competences, readiness to cooperate within the team.

Course objective

To acquaint students with the structure, principle of operation and the possibilities of using renewable energy sources (mainly photovoltaic and wind systems). Acquiring practical skills to connect and measure simple generation systems composed of RES.

Course-related learning outcomes

Knowledge:
1. has knowledge of the phenomena and processes that convert energy from renewable sources into electricity
2. has knowledge of the structure, parameters and modeling methods of basic generation elements of RES systems
3. has knowledge of the measurement methods of simple generation systems with renewable energy sources

Skills:
1. is able to obtain information from the literature, interpret the obtained results and draw conclusions
2. knows how to plan and carry out a measurement experiment of the RES generation system in accordance with the adopted assumptions, taking into account its geographical location
3. is able to use appropriate methods and tools for the measurement and analysis of wind and solar energy resources and RES systems

Social competences:
1. is aware of the importance and understanding of the non-technical aspects and effects of engineering activities, including its impact on the environment, and the related responsibility for decisions made

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The skills acquired in the laboratory will be verified on the basis of the assessment of knowledge and skills related to the implementation of laboratory exercises and reports made on them. Additionally, an increase in knowledge and the ability to use the learned principles and measurement methods will be rewarded. Laboratory classes are held in groups of several people and reports are made individually.

Programme content

Getting to know the structure, principle of operation and operating characteristics of various types of photovoltaic modules, wind turbins and heat pumps in various configurations and operating conditions. Planning the measurement methodology, measurements and calculations of the characteristic parameters of the above-mentioned devices.

Course topics

Getting to know the structure, principle of operation and operating characteristics of various types of photovoltaic modules, wind turbins and heat pumps in various configurations and operating conditions. Planning the measurement methodology, measurements and calculations of the characteristic parameters of the above-mentioned devices.
Laboratory classes include issues related to:
- determining the current-voltage characteristics of photovoltaic modules and the influence of various factors on them (including irradiance, temperature, connection method, radiation wavelength, module shape)
- experimental study of wind turbines (VAWT, HAWT) and their characteristic parameters,
- testing various systems cooperating in installations with renewable energy sources (wind turbines, PV modules),
- types and analysis of heat pumps operation.

Teaching methods

Laboratory: work in groups, use of measuring devices, work with technical documentation of devices and connection diagrams of tested systems, development of documentation (reports) on the performed measurements.

Bibliography

Basic:
1. Jastrzębska G., Ogniwa słoneczne. Budowa, technologia i zastosowanie, Wydawnictwa Komunikacji i Łączności, Warszawa, 2013.
2. Haberlin H, Photovoltaics system design and practice, Wiley, 2013.
3. Jenkins D., Renewable Energy Systems, Earthscan Expert, 2013.
4. Tytko R.: Urządzenia i systemy energetyki odnawialnej, Kraków 2019
5. Klugmann-Radziemska E.: Odnawialne źródła energii. Przykłady obliczeniowe, Gdańsk 2016

Additional:
1. Głuchy D., Kurz D., Trzmiel G., The impact of shading on the exploitation of photovoltaic installations, Renewable Energy, vol. 153, p. 480-498, June 2020, DOI: https://doi.org/10.1016/j.renene.2020.02.010.

2. Trzmiel G., Analiza metod regulacji mocy w elektrowniach wiatrowych, Computer applications in electrical engineering vol. 89/2017, Poznan University of Technology Academic Journals Electrical Engineering, Poznań, 2017, str. 395-404.
3. Trzmiel G., Układy śledzące punkt maksymalnej mocy w inwerterach stosowanych w instalacjach fotowoltaicznych, Computer applications in electrical engineering vol. 87/2016, Poznan University of Technology Academic Journals - Electrical Engineering, Poznań, 2016, str. 23 - 36.
4. Lubośny Z, Farmy wiatrowe w systemie elektroenergetycznym, Wydawnictwo WNT, Warszawa, 2013.
5. Kurz D., Morawska L., Piechota R., Trzmiel G., Analysis of the impact of a flexible photovoltaic tile shape on its performance, E3S Web of Conferences, vol. 44, 2018 (00085), https://doi.org/10.1051/e3sconf/20184400085
6. Internet: specjalistyczna literatura tematu, karty katalogowe, normy, ustawy.

Breakdown of average student's workload

	Hours	ECTS
Total workload	28	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	13	0,50