COURSE DESCRIPTION CARD - SYLLABUS

Course name
Renewable energy sources

Course

Field of study
Electrical Engineering

Year/Semester
4/7

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
10	10	
Tutorials	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
Ph.D. Grzegorz Trzmiel

e-mail: Grzegorz.Trzmiel@put.poznan.pl

phone: 616652693

Faculty of Control, Robotics and Electrical Engineering

Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of physics, electrical engineering and mathematics (on a general level). The ability to effectively self-education in a field related to the chosen field of study. The awareness of the need to expand their competence, their willingness to cooperate within the team.

Course objective

To acquaint students with the structure, principles of operation and application possibilities of renewable energy: photovoltaic, wind energy and water. Reason the need to replace conventional sources for renewable, due to the depletion of the former and growing environmental pollution. Presentation of new opportunities in the field of sourcing electricity.

Course-related learning outcomes

Knowledge

1. Has ordered and theoretically founded knowledge in the field of renewable energy sources,

2. Knows and understands the phenomena and processes that allow for the conversion of energy from RES in electricity,

3. Orients itself in the current state of development of renewable energy sources and prospective trends in Poland and in the world.

Skills

1. Can obtain information from the literature, databases and other sources, analyze it and interpret, draw conclusions, justify opinions,

2. Can work independently and in a team, use a properly chosen methods and devices in terms of performance and electrical characteristics,

3. Can interpret the results, draw conclusions.

Social competences

1. Can work individually and together in a group,

2. Is aware of the the importance and understanding of the non-technical aspects and impact of engineering activities, including its impact on environment and associated with this responsibility for decisions.

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 by passing the lecture lasting about 45-60 minutes, consisting of 10-15 questions (test and open), variously scored. Passing threshold: 50% of points. The issues on the basis of which questions are prepared will be sent to students by e-mail using the university's e-mail system.

Skills acquired as part of the laboratory are verified on the basis of: grades from reports on exercises performed. In addition, the following are taken into account for the final evaluation of the laboratories: rewarding the knowledge necessary to implement the problems posed in a given area of laboratory tasks, activity during each class, rewarding the increase in the ability to use known principles and methods, assessment of knowledge and skills related to the implementation of the exercise task.

In addition, students can get extra points for activity during classes, especially for: proposing to discuss additional aspects of the subject, the effectiveness of applying the acquired knowledge when solving a given problem, the ability to work within a team that practically performs a specific task in the laboratory, comments related to improving teaching materials, diligence aesthetic of the developed tasks within self-study.

Programme content

Lectures:

Reason the need for renewable energy sources. Legal conditions. Characteristics of renewable energy sources. Characteristics of devices that enable the conversion and storage of energy from RES: photovoltaics, wind energy and water. The costs of generation, transmission and distribution of electricity. RES impact on the environment. Estimating the energy yield. Application possibilities in various fields. Advantages, disadvantages, limitations of such solutions. Presenting innovative solutions in the field of the subject, applied in the latest practical solutions.

Laboratories:

Familiarization with the construction, principle of operation and operating characteristics of various types of solar modules, wind power plants and fuel cells in various configurations and operating conditions. Planning measurement methodology, measurements and calculations of the characteristic parameters of the above devices.

Teaching methods

Lecture: multimedia presentations with figures, diagrams, photos, supplemented with practical examples on the board, slides and computer programs, facilitating the linking of theory to practice. Lecture supplemented with additional materials provided to students for self study. Use students' knowledge of other subjects, initiate discussions, ask questions to increase student activity and autonomy.

Laboratory: Team work (measurements) at physical positions modeling the work of renewable energy sources in the field of photovoltaics, wind energy and hydrogen cells in cooperation with e.g. energy storage and charging regulators.

Bibliography

Basic

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

2. Jastrzębska G., Ogniwa słoneczne. Budowa, technologia i zastosowanie, Wydawnictwa Komunikacji i Łączności, Warszawa, 2013.

3. Wolańczyk F., Elektrownie wiatrowe, Wydawnictwo KaBe, Krosno, 2009.

4. Lewandowski W.: Proekologiczne źródła energii odnawialnej, WNT, Warszawa 2012.

5. Corkish R., Sproul A., and others, Applied Photovoltaics, 3rd Edition , Taylor&Francis eBooks, 2013.

6. Haberlin H, Photovoltaics system design and practice, Wiley, 2013.

7. Jenkins D., Renewable Energy Systems, Earthscan Expert, 2013.

8. White S., Solar Photovoltaic Basics, Taylor&Francis Ltd, 2015.

Additional

1. Ciok Z., Ochrona środowiska w elektroenergetyce, PWN, Warszawa 2001.

2. Zimny J., Odnawialne źródła energii w budownictwie niskoenergetycznym, Wydawnictwa Naukowo-Techniczne, Kraków-Warszawa, 2010.

3. Paska J., Wytwarzanie energii elektrycznej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.

4. Lubośny Z, Farmy wiatrowe w systemie elektroenergetycznym, Wydawnictwo WNT, Warszawa, 2013.

5. 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.

6. 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.

7. Trzmiel G., Determination of a mathematical model of the thin-film photovoltaic panel (CIS) based on measurement data. Eksploatacja i Niezawodnosc – Maintenance and Reliability 2017; 19 (4): 516–521, http://dx.doi.org/10.17531/ein.2017.4.4.

8. 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.

9. Internet: specialist subject literature, datasheets, standards.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,0
Classes requiring direct contact with the teacher	25	1,0
Student's own work (literature studies, preparation for laboratory classes and laboratory passing, preparation for passing the lecture) [1]	30	1,0

[1] delete or add other activities as appropriate