COURSE DESCRIPTION CARD - SYLLABUS

Course name

Renewable Energy Sources in Power Engineering

Course

Field of study

Power 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

10

Laboratory classes

10

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

Dr inż. Dariusz Kurz

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Responsible for the course/lecturer:

Prerequisites

Basic knowledge of physics, electrical engineering and mathematics (general level). The ability to effectively self-educate in a field related to the chosen field of study. 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 application possibilities of renewable energy sources: photovoltaics, biomass as well as wind, water and geothermal energy. Justification for the need to replace conventional sources with renewable ones, due to the depletion of the former and

the increasing environmental pollution. Presentation of new possibilities in the field of obtaining electricity.

Course-related learning outcomes

Knowledge

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

2. Knows and understands the phenomena and processes that allow the conversion of energy from renewable energy sources into electricity,

3. Is aware of the current state of RES development and prospective trends in Poland and in the world.

Skills

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

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

3. Interpret the obtained results, draw conclusions.

Social competences

1. Is aware of the importance and understands the non-technical aspects and effects of an energy engineer's activity, including its impact on the environment and the associated responsibility for own decisions.

2. Is aware of responsibility for their own work and readiness to submit to the principles of teamwork and responsibility for jointly performed tasks.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired in the course of the lecture is verified by completing the course lasting approx. 45-60 minutes, consisting of 10-15 questions (test and open), with different scores. Passing threshold: 50% of points. The issues on the basis of which the questions are developed will be sent to students by e-mail using the university's e-mail system.

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

In addition, the student can earn additional points for activity during classes, and especially for: proposing to discuss additional aspects of the issue, the effectiveness of applying the acquired knowledge when solving a given problem, the ability to cooperate as part of a team practically

implementing a detailed task in the laboratory, comments related to the improvement of teaching materials, diligence aesthetic of the tasks being developed as part of self-study.

Programme content

Lectures:

Justification of the necessity to use renewable energy sources. Legal conditions. Characteristics of renewable energy sources. Characteristics of devices enabling conversion and storage of energy from RES: photovoltaics, biomass as well as wind, hydro and geothermal energy. Costs of generation, transmission and distribution of electricity. The impact of RES on the natural environment. Energy yield estimation. Application possibilities in various fields. Advantages, disadvantages and limitations of this type of solutions. Presentation of innovative solutions in the field of the subject, used in the latest practical solutions.

Laboratories:

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

Teaching methods

Lecture: multimedia presentations containing drawings, diagrams, photos, supplemented with practical examples on the blackboard, slides and computer programs, which makes it easier to combine theory with practice. The lecture is supplemented with additional materials provided to students for independent study. Using students 'knowledge of other subjects, initiating discussions, asking questions to increase students' activity and independence.

Laboratories: Team work (measurements) on physical stands modeling the operation 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. Corkish R., Sproul A., and others, Applied Photovoltaics, 3rd Edition , Taylor&Francis eBooks, 2013.

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

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

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

8. Tytko R.: Urządzenia i systemy energetyki odnawialnej, Kraków 2019

9. Krawiec F.: Odnawialne źródła energii w świetle globalnego kryzysu energetycznego, Warszawa 2010

10. Klugmann-Radziemska E.: Odnawialne źródła energii. Przykłady obliczeniowe, Gdańsk 2016

11. Lewandowski W.M., Klugmann-Radziemska E.: Proekologiczne odnawialne źródła energii, Warszawa 2017

12. Kapuściński J., Rodzoch A.: Geotermia niskotemperaturowa w Polsce i na świecie, Warszawa 2010

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. 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.

8. Głuchy D., Kurz D., Trzmiel G.: Charakterystyka źródeł biomasy w Polsce, Przegląd Naukowo – Metodyczne. Edukacja dla Bezpieczeństwa, Wojskowa Akademia Techniczna, 1/2016, Poznań, Polska, str. 1240 – 1256.

9. Głuchy D., Kurz D., Trzmiel G.: Kryteria doboru modułu fotowoltaicznego do mikroinstalacji, Poznan University of Technology Academic Journals. Electrical Engineering, vol. 81, 2015, Poznań, Polska, str. 169 – 175.

10. Kurz D., Lewandowski K., Szydłowska M.: Analysis of efficiency of photovoltaic bifacial cells, Computer Application in Electrical Engineering (ZKwE), 23 – 24 kwiecień 2018, Poznań, Polska, ITM Web of Conferences 19/2018, EDP Sciences, pp. 01020, https://doi.org/10.1051/itmconf/20181901020.

11. Trzmiel G., Głuchy D., Kurz D.: The impact of shading on the exploitation of photovoltaic installations, Renewable Energy, 02/2020, https://doi.org/10.1016/j.renene.2020.02.010

12. Głów A., Kurz D.: Sposoby ochrony instalacji fotowoltaicznych przed następstwami zacienień, Poznan University of Technology Academic Journals. Electrical Engineering, vol. 79, 2014, Poznań, Polska, str. 113 – 120

13. Głuchy D., Kurz D., Trzmiel G.: Studying the impact of orientation and roof pitch on the operation of photovoltaic roof tiles, Przegląd Elektrotechniczny, 06/2013, Warszawa, Polska, pp. 281 – 283

14. Internet: specjalistyczna literatura tematu, karty katalogowe, normy.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,0
Classes requiring direct contact with the teacher	20	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests)[1]	35	1,0

[1] delete or add other activities as appropriate