POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modern RES technologies [S2Elenerg1-ŹOiME>WT2]

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

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

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of electrical engineering, mathematics and renewable energy (general level). The ability to effectively self-educate in a field related to the chosen field of study. Awareness of the need to expand their competences, readiness to cooperate as part of the team.

Course objective

To acquaint students with the structure, principle of operation and application possibilities of selected renewable energy sources, taking into account the latest solutions in the following areas: photovoltaics, solar radiation concentrators, systems following the sun, wind and water energy. Justification of the necessity to replace conventional sources with renewable ones, due to the depletion of the former and increasing environmental pollution. Presentation of the latest opportunities in the field of obtaining electricity in the country and in the world.

Course-related learning outcomes

Knowledge:
1. has an ordered and theoretically founded knowledge of renewable energy sources and their cooperation with the power system.

2. knows and understands the phenomena and processes that allow the conversion of energy from renewable energy sources into electricity.
3. is familiar with the issues of energy security, 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 evaluate the applied technical and organizational measures in the area of energy security.
3. can make an economic analysis of the applied energy solutions and implemented systems.

Social competences:
1. is aware of the importance of broadly understood energy security and the promotion of activities in the society related to the development of res in the power system.
2. is aware of and responsible for their own work and is ready to submit to the principles of teamwork, can think and act in a creative and entrepreneurial manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures:
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.
Laboratories:
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 skills and using the learned rules 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 in particular 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 of the tasks being developed as part of self-study.

Programme content

Lectures:
Justification for the need to use renewable energy sources. Legal conditions. Characteristics of the latest solutions used in renewable energy sources. Characteristics of devices enabling the conversion and storage of energy from RES: wind energy (offshore farms, the latest design solutions of turbines), solar radiation concentrators (CSP) with paraboid mirrors and thermal energy storage, solar collectors and PV/T systems, solutions in the field of photovoltaics, outflow to increase the energy efficiency of modules (optimizers, half-cells, bifacial cells), water turbines (eg. Archimedes, Pelton), the use of agricultural biogas and algae for energy production. Advantages, disadvantages, limitations of technical solutions. Presenting innovative solutions in the field of the subject, used in the latest practical solutions.
Laboratories:
Getting acquainted with the construction, principle of operation and operating characteristics of various types of photovoltaic modules (traditional and bifacial), wind turbines, fuel cells, water turbines in various configurations and working conditions discussed during the lectures. Planning the measurement methodology, measurements and calculations of the characteristic parameters of the above-mentioned devices.

Teaching methods

Lectures: 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 to be provided to students for independent study. Using students" knowledge of other subjects, initiating discussions, asking questions to increase student activity and independence.
Laboratories: Team work (measurements) on physical stands modeling the work of renewable energy sources in the field of photovoltaics, wind energy, hydrogen cells and water turbines in cooperation with e.g. energy storage and charging regulators.

Bibliography

Basic
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2. Haberlin H, Photovoltaics system design and practice, Wiley, 2013.
3. Jenkins D., Renewable Energy Systems, Earthscan Expert, 2013.
4. White S., Solar Photovoltaic Basics, Taylor&Francis Ltd, 2015.
5. Tytko R.: Urządzenia i systemy energetyki odnawialnej, Kraków 2019
6. Lewandowski W.M., Klugmann-Radziemska E.: Proekologiczne odnawialne źródła energii, Warszawa 2017
7. Jastrzębska G.: Energia ze źródeł odnawialnych i jej wykorzystanie, WKŁ, Warszawa, 2017
8. Sarniak T.: Systemy fotowoltaiczne, 2019, Oficyna Wydawnicza Politechniki Warszawskiej
Additional
1. Lovegrove K., Stein W., Concentrating solar power technoology. Principles, developments and applications. Woodhead Publishing Limited, UK 2012.
2. Coccia G., DiNicola G., Hidalgo A., Parabolic trough collector prototype for low-temperature process heat, Springer, 2016,
3. Forristall R., Heat transfer analysisand modeling of a parabolic through solar receiver implemented in engineering equation solver, National Renewable Energy Laboratory, NREL/TP-550-34169, 2003,
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8. Trzmiel G., Głuchy D., Kurz D.: The impact of shading on the exploitation of photovoltaic installations, Renewable Energy, 153, 2020, pp. 480-498, https://doi.org/10.1016/j.renene.2020.02.010.
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10. Bugała A., Roszyk O.:Investigation of innovative rotor modification for a small-scale horizontal axis wind turbine, Energies, 13(10), 2020.
11. Internet: specjalistyczna literatura tematu, karty katalogowe, normy.

Breakdown of average student's workload

	Hours	ECTS
Total workload	56	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	26	1,00