COURSE DESCRIPTION CARD - SYLLABUS

Course name
Renewable energy technologies and energy saving systems [N1Energ2>TEOiSE]

Course

Field of study
Power Engineering

Year/Semester
5/9

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
20

Laboratory classes
10

Other (e.g. online)
0

Tutorials
0

Projects/seminars
10

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, electrical engineering and renewable energy sources. The ability to effectively self-study in a field related to the chosen field of study. Ability to study literature, inference. The awareness of the need to expand their competences, readiness to cooperate within a team.

Course objective

Extending knowledge related to the structure, principles of operation, parameters and application possibilities of solar cells and wind turbines. Understanding the technical and technological issues of geothermal energy, heat pumps and biomass. To acquaint students with the methods and possibilities of cooperation of various renewable energy sources (electricity and heat). Justification of the need to replace conventional sources with renewable ones, due to the depletion of the former resources and increasing environmental pollution. Presentation of new possibilities in the field of obtaining electricity and heat and possibilities of reducing its consumption. Presentation of modern technologies used in the renewable energy sector.

Course-related learning outcomes

Knowledge:

1. has structured and theoretically knowledge of renewable energy sources; knows the phenomena, processes and devices allowing the conversion of energy from wind, sun, biomass, geothermal energy into electricity and heat.
2. knows the methods and principles of design and simulation of renewable energy systems in available commercial programs and using mathematical equations.
3. knows the construction and operation principles of devices used to generate electricity and heat from renewable energy sources.
4. is aware of the current state of renewable energy development and prospective trends in Poland and in the world, as well as unconventional energy resources.

Skills:
1. is able to obtain information from literature and datasheets, analyze and interpret them in order to select components of the designed system or installation.
2. is able to work independently and in a team, use properly selected methods and devices in the field of electrical parameters and characteristics.
3. design installations using renewable energy sources using available computer programs and assess their operation in energy and economic terms.
4. interpret the obtained results, draw conclusions regarding various design solutions for energy generation systems (electrical and / or heat) from renewable sources due to the set utility, technical and economic criteria.

Social competences:
1. is able to work individually and cooperate in a group as well as think and act in an entrepreneurial manner.
2. is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for the decisions taken, and the importance of knowledge in solving practical problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by passing the exam lasting about 60-70 minutes, consisting of test and open questions, variously scored. Passing threshold: 50% of points. The issues on the basis of which questions are prepared will be successively indicated in classes.
Skills acquired as part of the project classes are verified on the basis of the assessment for the implementation of the project task regarding the selection of appropriate elements of the selected renewable energy sources installation in accordance with the assumed criteria.
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 the learned 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: offering to discuss additional aspects of an issue, the effectiveness of applying the acquired knowledge when solving a given problem, the ability to cooperate within a team that practically performs a specific task in a laboratory, and aesthetic care of developed tasks.

Programme content

Justification of the need to use renewable energy sources (RES). Characteristics of renewable energy sources, such as: geothermal energy, solar farm, wind energy, biomass. Characteristics of devices enabling conversion and storage of energy from RES. Costs of generating electricity and heat obtained from various types of RES. Application possibilities in various areas. Advantages, disadvantages, limitations of this type of solutions. Presenting innovative
solutions in the field of the subject, used in the latest practical solutions.
Analysis of technical documentation of the components of installations in the field of renewable energy for the production of electricity and heat.

Course topics

Lecture:
Justification of the need to use renewable energy sources (RES). Legal conditions. Characteristics of renewable energy sources, such as: geothermal energy, solar farm, wind energy, biomass. Characteristics of devices enabling conversion and storage of energy from RES. Costs of generating electricity and heat obtained from various types of RES. Estimating energy yield. Application possibilities in various areas. Advantages, disadvantages, limitations of this type of solutions. Presenting innovative solutions in the field of the subject, used in the latest practical solutions.
Laboratories:
Getting to know the construction, principle of operation and performance characteristics of various types of solar modules, solar collectors, wind turbines and heat pumps in various configurations and operating conditions. Planning measurement methodology, measurements and calculations of the characteristic parameters of the above devices.
Projects:
Getting to know the principles of design, simulation and analysis of energy yields from various renewable energy sources (photovoltaics, solar collectors, heat pumps, wind turbins) using mathematical models and computer programs. Analysis of technical documentation of the components of installations in the field of renewable energy for the production of electricity and heat.

Teaching methods

Lecture: multimedia presentations including drawings, diagrams, photos, supplemented with practical examples on the board, slides and computer programs, which makes it easier to link theory and practice. The lecture supplemented with additional materials provided to students for independent study. Utilizing students' knowledge of other subjects, initiating discussions, asking questions to increase students' activity and independence.
Laboratories: Team work (measurements) at physical positions modeling the work of renewable energy sources in the area of solar farms, solar collectors, wind energy and heat pumps in cooperation with e.g. energy storage and charging regulators.
Projects: Team work using datasheets of devices and elements of renewable energy systems (PV panels, PV inverters, solar collectors, heat pumps, wind turbines) in order to develop the installation project in accordance with the assumed criteria.

Bibliography

Basic:
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3. Klugmann-Radziemska E.: Odnawialne źródła energii. Przykłady obliczeniowe, Gdańsk 2016
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5. Kapuściński J., Rodzoch A.: Geotermia niskotemperaturowa w Polsce i na świecie, Warszawa 2010
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Additional:
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Technology Academic Journals - Electrical Engineering, Poznań, 2016, str. 23 - 36.
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Breakdown of average student's workload

	Hours	ECTS
Total workload	142	5,00
Classes requiring direct contact with the teacher	42	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	100	3,50