COURSE DESCRIPTION CARD - SYLLABUS

Course name
Renewable sources of energy [S1IŚrod1>OŹE]

Course

Field of study
Environmental Engineering

Year/Semester
4/7

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
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

1. Knowledge: Knowledge of selected issues in physics, chemistry and biology. Basic principles and laws in the field of technical thermodynamics, heat exchange and fluid mechanics. 2. Skills: Application of known laws and relationships to explain phenomena occurring in equipment converting energy from renewable sources. Designation of indicators for assessing the energy and economic efficiency of systems using renewable energy sources. 3. Social competencies: Be aware of the need to continually update and refine your knowledge and skills. Exchange of experience with design and execution entities.

Course objective

To acquire knowledge and skills in system design and selection of renewable energy sources for practical applications in heating and hot water heating systems.

Course-related learning outcomes

Knowledge:
1. the student has an organized and theoretical knowledge of physics, chemistry, biology, thermodynamics and other fields of environmental engineering to formulate and solve complex environmental engineering tasks (lect.) - [kis1_w01]
2. the student has an organized and theoretical knowledge of the possibilities of obtaining energy from renewable energy sources (lect.) - [kis1_w05]

3. the student has a structured knowledge of the construction, operation principles and methods of energy conversion in the devices for its acquisition (lect.) - [kis1_w05]
4. the student has an orderly and detailed knowledge of the life cycle of equipment, facilities and technical systems used in environmental engineering - solar collectors, heat pumps, geothermal water, biomass (lect.) - [kis1_w06]
5. student knows basic methods, techniques, tools and materials used in energy technologies based on non-renewable and renewable primary energy carriers (lect.) - [kis1_w07]
6. student knows the general principles of creating and developing forms of individual entrepreneurship, using knowledge of environmental engineering (lect.) - [kis1_w11]

Skills:
1. student can acquire, analyze and appropriately use information from polish and foreign literature on renewable energy sources (proj.) - [kis1_u01]
2. the student is able to calculate, design and select a system to obtain energy from unconventional sources (proj.) - [kis1_u07, kis1_u08]
3. student can compare the energy efficiency of various devices and systems to obtain energy from unconventional sources (proj.) - [kis1_u11, kis1_u12]
4. the student is able to perform a preliminary economic analysis of the undertaken engineering activities with respect to renewable and non-renewable primary energy sources for heating systems and hot water heating (proj.) - [kis1_u14]

Social competences:
1. the student sees the need to systematically deepen and broaden their competences (lect.) - [kis1_k01]
2. the student is able to cooperate in the group, taking in various functions (proj.) - [kis1_k03]
3. student is aware of the importance and effects of engineering activities, including its impact on the environment (proj.)- [kis1_k02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture:
Single part written test of the lecture, consisting of closed and opened questions. The date of the test will be announced at the beginning of the semester. At least 50% of the score is required to pass the test. Used scale of grades: (NB-absent; 2,0; 3,0; 3,5; 4,0; 4,5; 5,0) (educational outcomes: W1-W6, K1).
Project:
Project development and defense in the form of multimedia presentation (work carried out in subgroups of students). The presentation includes the theoretical and computational part. (outcomes: U1-U4, K2, K3). At least 50% of correctly completed tasks is required to pass the project. Used scale of grades: (NB-absent; 2,0; 3,0; 3,5; 4,0; 4,5; 5,0)
Evaluation of activity on exercises.

Programme content

Lectures:
1. Conventional and unconventional energy sources of energy: definitions and types.
2. Renewable energy sources in the world, in Europe and in Poland: statistics, commercialized technologies, new technologies, installations costs.
3. Wind energy: obtaining of electricity from wind turbines: types of wind turbines, principle of operation.
4. Hydro energy: electricity generation from hydropower plants: types, principle of operation.
5. Solar energy: types of solar collectors, construction and operation of flat and vacuum collectors, collector selection calculations, solutions for hot water heating systems using collectors as heat sources in a bivalent system. Electricity obtaining from photovoltaic panels.
6. Compressor heat pump: schematic and principle of operation, types of lower heat sources, design calculations of the selection of different heat sources, solutions of heating systems with heat pumps as heat sources in bivalent systems.
7. Geothermal energy: ways of using geothermal sources, geothermal heating as a source of heating and hot water heating systems, heating solutions using geothermal energy

8. Biomass: methods of energetic use of biomass, devices and installations for pellet and straw combustion, examples of heating solutions using biomass-fired equipment - pellets, straw, biogas
Project:
1. Determining the type of renewable energy source for a given user.
2. Calculations related to the selection of equipment and components of the installation.
3. Diagram of a heating installation using renewable energy.

Teaching methods

Lectures:
All information are presented in the form of multimedia presentation. Selected issues are discussed in wider approach using additional materials: blackboard, printed materials.
Project:
The scope of the project is presented in the form of multimedia presentation. Detailed presentation of all parts of the project i.e. calculation examples, devices selection, requirements for drawings and schemes. All meetings consist of individual assessment of students projects progress and discussion on proper realization of each part of the project. All information and detailed description of each part of the project is available to students within a web course (e-learning, MOODLE platform).

Bibliography

Basic
1. Lewandowski Witold M., Proekologiczne odnawialne źródła energii, Wydawnictwa Naukowo-Techniczne Warszawa 2007
2. Foit Henryk, Zastosowanie odnawialnych źródeł ciepła w ogrzewnictwie i wentylacji, Wydawnictwo Politechniki Śląskiej Gliwice 2010
3. Rubik Marian, Pompy ciepła w systemach geotermii niskotemperaturowej, MULTICO Oficyna Wydawnicza Warszawa 2015
4. Wiśniewski Grzegorz , Kolektory słoneczne. Poradnik wykorzystania energii słonecznej, Wydawnictwo: centralny Ośrodek Informacji Budownictwa, Warszawa 1992
5. Klugmann-Radziemska Ewa, Odnawialne źródła energii. Przykłady obliczeniowe, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2009
Additional
1. Kusto Zdzisław, Współpraca pomp ciepła ze źródłem konwencjonalnym. Algorytmy obliczania bilansu energetycznego i efektywności ekonomicznej, Wydawnictwo Gdańskiej Wyższej Szkoły Administracji, Gdańsk 2009
2. Nowak W., Stachel A.A., Borsukiewicz-Gozdur A., Zastosowania odnawialnych źródeł energii, Wydawnictwo Uczelniane Politechniki Szczecińskiej Szczecin 2008

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
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)	45	2,00