COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technological objects and devices in environmental engineering [S1IŚrod1>OiKŹE]

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

2,00

Coordinators

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Lecturers

Prerequisites

Basic principles and laws of technical thermodynamics, heat transfer, fluid mechanics and energy management. Fundamentals of heating: heat balancing for radiator selection, design and hydraulic balancing of central heating systems with panel radiators. Fundamentals of heating: ordered heat load diagram (circular and sawtooth diagram), classification of heat sources, heat networks and nodes. Application of known laws and relationships to explain the phenomena occurring in energy conversion devices. Determination of indicators for evaluating the energy and economic efficiency of energy systems. Awareness of the need to constantly update and supplement knowledge and skills.

Course objective

To impart knowledge of renewable and conventional energy sources for buildings and the technical possibilities of obtaining energy using equipment available on the market. Recall and expansion of selected topics in district heating. Basics of selection of energy sources for buildings and their cooperation with technical building equipment. Presentation of the characteristics of various energy sources, hydraulic/ technological schemes and the impact of heat source selection on the energy performance of the building.

Course-related learning outcomes

Knowledge:
1. The student has knowledge of renewable and conventional energy sources for buildings and their availability.
2. He knows the basic hydraulic and technological schemes of selected energy sources for buildings.
3. Has knowledge of energy generation equipment and their energy efficiency.
4. Has knowledge of the components of utility, final and primary energy balances.
5. Has knowledge of legal considerations related to the energy performance of buildings.

Skills:
1. The student is able to obtain, analyze and appropriately use information from the Polish and foreign literature in the field of energy sources, as well as search for information on legal requirements for energy assessment of buildings.
2. Is able to select a system for obtaining energy from non-conventional sources.
3. Is able to quantitatively compare the energy efficiency of various devices and systems for energy extraction.
4. Is able to make a preliminary economic and energy analysis of the engineering measures taken in relation to renewable and non-renewable primary energy carriers for the building.
5. Is able to create a calculation sheet used to calculate the energy performance of a building.
6. Is able to fill in the energy performance certificate of the building in accordance with the current legal requirements.
7. Is able to work in a group and formulate opinions related to the analysis.
8. Can perform calculations in accordance with current legal regulations based on independent analysis of the provisions of these regulations, bearing in mind that the regulations may change.

Social competences:
1. The student sees the need to systematically deepen and expand his/her competence.
2. Is aware of the importance and consequences of engineering activities including its impact on the environment.
3. Is aware that engineering activities related to the selection of energy sources have an impact on the environment.
4. Is aware of the need to consult with experts, especially in cases when the legislation describing the methodology of performing calculations changes.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
Credit in the form of questions (and/or): open, calculation, drawing, test questions of various types.
Grading scale: 0-50%: 2,0; 51-60%: 3,0; 61-70%: 3,5; 71-80%: 4,0; 81-90%: 4,5; 91-100%: 5,0.
Bonus attendance: +0.5 grade for attendance at 5 lectures, +1.0 grade for attendance at 7 lectures (condition: minimum test score of 40%).
Project:
The final grade takes into account the regularity, timeliness and completeness of the performance of all tasks and the final test with open and closed questions. Grading scale: 0-49 points = 2.0; 50-59pts=3.0; 60-69pts=3.5; 70-79pts=4.0;80-89pts=4.5; 90-100pts=5.0"

Programme content

Lectures:
1. Overview of renewable and conventional energy sources for buildings.
2. Basics of selection of energy source for buildings.
3. Construction and principle of operation of selected devices, e.g.: condensing gas boiler, heat pump, solar collectors, PV collectors, ground heat exchangers, hydrogen cells, cogeneration sources. Hydraulic diagrams.
4. Impact of the choice of heat source on the energy performance of the building.
Project:
Performing design energy characterization with analysis of the impact of the selection of heat sources on the energy indicators of buildings.
Input data: Calculated (set) value of usable energy for heating and ventilation for a single-family building and a selected public building, and a diagram of the heat source and HVAC system.

Teaching methods

Lectures:
Informative lecture with elements of a conversational lecture; Problem lecture; Multimedia presentation; Discussion
Project:
Individual work on the project; Consultations; Interactive task completion

Bibliography

Basic:
[1] Dz.U.2015.376: Rozporządzenie Ministra Infrastruktury i Rozwoju z dnia 27 lutego 2015 r. w sprawie metodologii wyznaczania charakterystyki energetycznej budynku lub części budynku oraz świadectw charakterystyki energetycznej lub jego następniki
[2] Wytyczne projektowania, wykonania i odbioru instalacji z pompami ciepła - część 1 do 8, PORT PC oraz informacje ze strony www.portpc.pl

Additional:
[1] Strzyżewski J., Pompy ciepła. Zasady działania i wybór rozwiązań, Wiedza i Praktyka, 2022
[2] Rubik M., Pompy ciepła - poradnik, Technika Instalacyjna w Budownictwie INSTAL, Warszawa 2006 lub Rubik M., Chłodnictwo i pompy ciepła, Grupa Medium, Warszawa 2021
[3] Oszczak W., Ogrzewanie domów z zastosowaniem pomp ciepła, Wydawnictwa Komunikacji i Łączności WKŁ, Warszawa, 2022
[4] Oszczak W., Kolektory słoneczne i fotoogniwa w Twoim domu, Wydawnictwa Komunikacji i Łączności WKŁ, Warszawa, 2022
[5] Chodura J., Instalacje słoneczne. Dobór, montaż i nowe konstrukcje kolektorów, Grupa Medium, Warszawa 2011
[6] Luberański A., Dębowski M., Michalski M., Polewka P., Petrukanec A., Systemy fotowoltaiczne i słoneczne systemy grzewcze - praktyczny poradnik instalatora, ATUM 2018 lub wydanie 2021
[7] Zimny J., Brzegowy R., Bielik S., Kolektory słoneczne - podstawy teoretyczne, budowa, badania, 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	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)	20	1,00