COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fuel and energy conversion [N1Energ2>PIPE]

Course

Field of study
Power Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
10

Other
0

Tutorials
10

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in the field of physics, chemistry, economic geography. The ability to effectively self-study in a field related to the chosen field of study. Is aware of the need to expand their competences, readiness to cooperate within a team

Course objective

Understanding the characteristics of energy fuels and how to use them for energy purposes, (how to convert some forms of energy into others).

Course-related learning outcomes

Knowledge:
1. Student has knowledge of the characteristics of gaseous, liquid and solid fuels as well as their resources and extraction in Poland and in the world.
2. The student has ordered and theoretically founded knowledge of the characteristics of the combustion process and stoichiometric calculations as well as the gasification process and the conversion of one fuel to another.
3. Student is knowledgeable about modern combustion and gasification technologies and devices used

in these processes.

Skills:
1. As a result of the course the student will be able to use the appropriate technological system to burn various types of fuels, taking into account the reduction of harmful substances.
2. Perform stoichiometric calculations for liquid and solid gaseous fuels, determine calorific value.

Social competences:
1. The student is aware of the environmental impact of the use of fossil fuels.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
- assessment of knowledge and skills demonstrated in the written test - required to obtain 50% of the points from the test
Tutorials:
- assessment based on a final test - required to obtain 50% of the number of points
Laboratory:
- assessment based on ongoing control of information and completed reports
- required to obtain a positive assessment (3 - dst) for all reports
Obtaining additional points for activity during classes, especially for:
- proposing to discuss additional aspects of the issue; - effectiveness of applying the acquired knowledge when solving a given problem;
- ability to cooperate within a team practically carrying out a detailed task in the laboratory;
- comments related to the improvement of teaching materials;
- aesthetic care in preparing reports and tasks as part of self-study.

Programme content

Fossil fuels and renewable fuels, resources and characteristics. The combustion process, devices, basic equations describing the combustion process and the efficiency of the combustion process. Highly efficient combustion technologies. Combustion safety.

Course topics

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Lecture:
Fossil fuels: (solid, liquid, gas) and renewable fuels (biomass, biofuels, hydrogen) and their characteristics. Municipal and industrial waste as a source of thermal energy.
Kinetics of elementary reactions. Chemical enthalpy. Heat of combustion, calorific value. Complete and incomplete combustion and complete and incomplete combustion. Fuel conversion processes: combustion, gasification, pyrolysis, torrefaction.
Basic equations describing the combustion process. Stoichiometric calculations: air demand for combustion of solid, liquid and gaseous fuels; volume and composition of exhaust gases.
Efficiency of the energy conversion process. Determining the efficiency of a power boiler - indirect, direct method, losses. Temperature in the furnace. Combustion safety: explosion, detonation.
Exercises:
Calculation tasks in the field of stoichiometry: air demand for combustion of solid, liquid and gaseous fuels; volume and composition of exhaust gases. Determining the efficiency of a power boiler - indirect and direct methods, losses in the power boiler.
Lab:
carrying out laboratory measurements in the field of: technical analysis of fuels (measurement of combustion heat and calorific value, content of ash, moisture and volatile substances), regulation and control of the combustion process,
biomass pelleting, electrolysis process and fuel cell, determining the energy efficiency of a heat pump.

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the blackboard
Tutorials: solving sample tasks on the board

Laboratory: classes at laboratory stations

Bibliography

Basic:
1. Kortylewski W.:Spalanie i Paliwa, Oficyna Wydawnicza Politechniki Wrocławskiej 2008
2. Wandrasz J. W., Wandrasz A. J.: Paliwa formowalne biopaliwa i paliwa z odpadów w procesach termicznych, wydawnictwo Seidel-Przywecki Sp. z o. o., Warszawa 2006.
3. Lewandowski W. M., Ryms M.:Biopaliwa, , WNT Warszawa, 2013

Additional:
1. Kruczek S.: Kotły. Konstrukcje i obliczanie, Oficyna Wydawnicza Politechniki Wrocławskiej, 2001
2. Kozaczka J.: Procesy zgazowania. Inżynierskie metody obliczeń. Wydawnictwa AGH, Kraków 1994
3. Chmielniak T. J.: Technologie energetyczne, , WNT , 2015.
4. Bis Z. Kotły fluidalne teoria i praktyka, , Częstochowa 2010
5. Robert Wróblewski , Bartosz Ceran, Thermogravimetric analysis in the study of solid fuels - E3S Web of Conferences - 2016, vol. 10, s. 00109-1-00109-6
6. Jacek Roman, Robert Wróblewski, Beata Klojzy-Karczmarczyk, Bartosz Ceran, Energetic, Economic and Environmental (3E) Analysis of a RES-Waste Gasification Plant with Syngas Storage Cooperation Energies - 2023, vol. 16, iss. 4, s. 2062-1-2062-29

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	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)	50	2,00