COURSE DESCRIPTION CARD - SYLLABUS

Course name
Industrial waste energy [S2IChiP1-IC>PEO]

Course

Field of study
Chemical and Process Engineering

Year/Semester
2/3

Area of study (specialization)
Chemical Engineering

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
0

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
30

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge in mathematics, physics, chemistry, thermodynamics, computer science and engineering graphics, materials science, machine science and process apparatus. Ability to understand simple technological process diagrams, understanding and independent design of simple devices and description of the basics in the field of heat exchange, combustion, industrial energy. Willingness to make decisions and cooperate within a specific team, being aware of the need to broaden their knowledge.

Course objective

The aim of the course is to acquaint the student with basic issues such as energy storage, high-temperature physical recuperation, low-temperature waste energy, recovery boilers, clean combustion techniques, ecology and economics of waste energy and future perspectives. In addition, the student is acquainted with the characteristics of the basic devices using and recovering waste energy lost in many technological processes.

Course-related learning outcomes

Knowledge:
1. knows the basic concepts of industrial waste energy, k_w04,

2. knows the selection of basic devices used in the chemical industry using waste energy, k_w04,
3. knows the methods of estimating energy saving costs and the impact of the devices used on the natural environment, k_w04, k_w09,

Skills:
1. can use terms related to waste energy, k_u01
2. can choose the right apparatus to minimize energy losses generated during the course of a specific process, k_u13, k_u16
3. can assess the economics of the construction solution used, k_u09, k_u16
4. can assess the impact of the equipment used on the environment, k_u09, k_u13
5. can solve problems individually and in a specific team and present the results obtained in this way, k_u02, k_u06

Social competences:
1. the student is aware of the limitations of their own knowledge, and therefore the need for education and development, k_k01, k_k02
2. the student knows the pros and cons of teamwork and adheres to the principles that accompany such a way of solving problems in industry, k_k05
3. can think and act in a creative and entrepreneurial way, k_k06

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Skills acquired as a part of the project classes are verified on the basis of the project carried out in groups of 2 and pass in the form of multimedia presentation and oral verification of the submitted project, consisting of 3-5 open questions related to the project. Passing threshold: 51% of points from oral answer and correctness of the prepared project.

Programme content

The classes will discuss the demand, resources, and the use and possibilities of industrial energy and its storage. As a part of the project classes, chemical industry equipment will be discussed:
- recuperators (convection, radiation, radiation-convection)
- structural recuperative burners
- heat pumps
- heat exchangers accompanying energy recovery devices
- industrial recovery boilers in the chemical industry
- industrial furnaces

Operational problems of recovery devices, fuel and clean combustion techniques as well as reduction of toxic components emission in industrial devices will also be discussed.

Teaching methods

1 Theoretical classes: multimedia presentation, illustrated with examples on the board, and supportive materials to classes sent to students by e-mail using the university e-mail system.
2. Project: multimedia presentation, presentation illustrated with examples given on a board, and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic
1. Szaferski W., Broniarz-Press L., Przemysłowa energia odpadowa, Wydawnictwo Politechniki Poznańska, 2012.
2. Szargut J., Ziębik A., Kozioł J., Kurpisz K., Majza E.: Przemysłowa energia odpadowa. WNT, Warszawa 1993.
3. Jarosiński J.: Techniki czystego spalania. WNT Warszawa 1996.
Additional
1. Krygier K., Klinke T., Sewerynik J., Ogrzewnictwo, wentylacja, klimatyzacja : podręcznik dla technikum. Wydawnictwa Szkolne i Pedagogiczne, Warszawa 2007
2. Butrymowicz D., Chłodnictwo i klimatyzacja. Wydawnictwo Naukowe PWN, Warszawa 2016

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5. Strzyżewski J., Pompy ciepła: zasady działania i wybór rozwiązań. Wydawnictwo Wiedza i Praktyka sp. z o.o., Warszawa 2017
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7. Bandrowski J., Mańka H., Piece rurowe. Wydawnictwo Politechniki Śląskiej, Gliwice 1994
8. Bujak J.W., Odzysk ciepła w procesie termicznej utylizacji odpadów medycznych. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2010
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10. Staniszewski D., Targański W., Odzysk ciepła w instalacjach chłodniczych i klimatyzacyjnych. IPPU Masta, Gdańsk 2007
11. Rosik-Dulewska Cz., Podstawy gospodarki odpadami. Wydawnictwo Naukowe PWN, Warszawa 2015
12. Bis Z., Kotły fluidalne: teoria i praktyka. Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2010

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