COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biomass and fossil fuel combustion [S2EPiO1-ECiO>SP]

Course

Field of study
Industrial and Renewable Energy Systems

Year/Semester
1/1

Area of study (specialization)
Thermal and Renewable Energy

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
15

Laboratory classes
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge gained during the studies in: thermodynamics, basics of automation, control and automation, boiler devices, heat and mass exchange, energy management, fuel combustion, environmental protection.

Course objective

In-depth knowledge of the theory of combustion of solid, liquid and gaseous fuels, including biomass. Getting acquainted with current trends related to the combustion process from the point of view of energy and environmental protection. Gaining knowledge in the field of optimization of fuel and biomass combustion processes in the aspects of modern technologies and development of energy equipment.

Course-related learning outcomes

Knowledge:
student has extended and deep knowledge in the field of solid, liquid and gaseous fuel combustion
student has expanded knowledge about the development trends of modern methods of combustion of conventional and renewable fuels (biomass) and renewable energy sources
student has deep knowledge of operational parameters impact of combustion process on energy machines and functioning of energy systems

Skills:
student is able to use his knowledge to find right sources and interpret founded information in order to solve both standard and non-standard engineering problems of combustion process
student is able to use his knowledge and skills to adapt existing or create new methods and tools to solve typical engineering problems in the modern technologies in combustion process
student is able to formulate and test hypotheses related to simple implementation problems

Social competences:
student is ready to critically assess knowledge and received information
student is ready to recognize the importance of knowledge in solving cognitive and practical problems and to seek expert opinions in case of difficulties in solving the problems of combustion process in energy
student is ready to fulfill social obligations as well as inspire and organize activities for the social environment

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture - written exam.

Exercises - written test. Obtaining credit from a minimum of 50% of the points possible to get. There is a possibility of an oral question to raise the grade.

Laboratory classes - submission of the report from the laboratory exercise and oral answer to the questions asked

Programme content

Introduction to combustion processes. Solid fuels: division, properties, characteristics. Liquid fuels: division, properties, characteristics. Gaseous fuels: division, properties, characteristics. Biofuels: division, properties, characteristics. Combustion chemistry, mechanisms and kinetics. Combustion temperature. Demand, oxygen, air, oxidant. Exhaust gas quantity and composition. Free flame aerodynamics and turbulent combustion models. Combustion of gaseous fuels. Combustion of liquid fuels. Combustion of solid fuels. Combustion of biomass.
Environmental aspects of combustion processes. Diagnostics of combustion processes.

Course topics

Topics in line with curriculum content

Teaching methods

Lecture - written exam
Exercises - written test
Laboratory classes - submission of the report from the laboratory exercise

Bibliography

Basic
1. W. Kordylewski red. – Spalanie i Paliwa, Oficyna Wydawnicza Politechniki Wrocławskiej, 2008
2. S. Wójcicki – Spalanie, WNT, 1969
3. W. Rybak – Spalanie i współspalanie biopaliw stałych, Oficyna Wydawnicza Politechniki Wrocławskiej, 2006

Additional
1. J. Nocoń, j. Poznański, S. Słupek, M. Rywotycki – Technika cieplna – przykłady z techniki spalania, Wydawnictwo AGH, 2007
2. J. Jarosiński – Techniki czystego spalania, WNT, 1996
3. W. Pudlik – Termiczna przeróbka odpadów podstawy teoretyczne, Wydawnictwo Politechniki Gdańskiej,

2015
4. Analysis of the effect of swirl flame shaping on emissions from the co-firing of ammonia and methane, Energy, 2024

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	0,50