



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Biomass and fossil fuel combustion

### Course

Field of study

Industrial and Renewable Energy

Area of study (specialization)

Thermal Engineering and Renewable Energy

Level of study

Second-cycle studies

Form of study

part-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

### Number of credit points

2

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Rafał Urbaniak

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tel. 61 6652331

Wydział Inżynierii Środowiska i Energetyki

Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

mgr inż. Bartosz Ciupek

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tel. 61 6652331

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Piotrowo 3, 60-965 Poznań

### 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:

Lecture - written exam. Exercises - written test. Obtaining credit from a minimum of 51% 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 the issues of combustion processes. Solid, liquid and gaseous fuels and biomass. Combustion chemistry, its mechanisms and kinetics. Aerodynamics of free flame and models of turbulent combustion. Combustion of gaseous fuels. Combustion of liquid fuels. Combustion of solid fuels. Biomass combustion. Environmental aspects of combustion processes. Diagnostics of combustion processes.

## 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

### Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	45	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	15	0,5

<sup>1</sup> delete or add other activities as appropriate