COURSE DESCRIPTION CARD - SYLLABUS

Course name
Combustion processes [S2EPiO1-TGiEO>PSP]

Course

Field of study
Industrial and Renewable Energy Systems

Year/Semester
1/1

Area of study (specialization)
Gas Technology 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
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic has knowledge in the field of fluid mechanics, physics, thermodynamics, chemistry and knowledge about combustion processes of natural gases . Student should also have skills to evaluate the results of experiments, observations, and calculations, and discuss measurements errors.

Course objective

To present knowledge about main thermodynamics parameters of flammable gases. Presentation of the thermodynamic quantities that describe the combustion process of gaseous fuels.

Course-related learning outcomes

Knowledge:
has expanded knowledge about the development directions of new low emission and high efficiency combustion technology
has ordered and in-depth knowledge necessary design of combustion systems for energetic machines and devices
knows the main direction of scientific research in field of fuel combustion

Skills:
is able to notice systemic and non-technical aspects during solving engineering tasks in the field of combustion processes.
is able to design and conduct experiments and simulations of combustion processes as well as process and interpret their results.
can independently plan and implement their own lifelong learning and guide others in this regard.

Social competences:
is ready to recognize the importance of knowledge field of fuel use and their impact on enviroment
he is ready to fulfill social obligations, inspire and organize activities for the social environment
it is ready to initiate actions for the social interest, especially in the area of reducing the negative impact of the use of fossil fuels

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: Knowledge acquired during the lecture is verified during the final test carried. Each test consists of 5 questions (open). Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.
Skills acquired as part of the laboratory classes will be verified basis on the final test, consisting of 10 tasks differently scored depending on their level of difficulty. Passing threshold: 50% of points.

Programme content

Lecture:
Thermodynamic and chemical fundamentals of combustion processes
Thermodynamic parameters describing the combustion of fuels
Types of flames in energy machines and appliances
Construction of burners and combustion chambers
Heat transfer in combustion chambers

Labs:
Evaluation of the combustion of gaseous fuels in selected industrial equipment and technologies
Calculation of equilibrium parameters of combustion processes

Course topics

lecture:
Combustion reactions of fuels, kinetics of combustion reactions
Discussion of thermodynamic quantities describing the combustion process: calorific value and heat of combustion, flammability limits, adiabatic combustion temperature, laminar and turbulent combustion velocity
laminar flame, methods for the determination of laminar combustion velocity, turbulent flame, methods for the determination of turbulent combustion velocity, flame instability of gaseous fuels,
basic types of gas burners, heat transfer mechanisms in combustion chambers
laboratories: analysis of fuel combustion process in kinetic and diffusion flame, calculation of equilibrium parameters of combustion process,
determination of laminar combustion velocity of selected fuel mixtures, measurement of diffusion flame length, analysis of toxic compound distribution and temperature in a vortex flame,

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board
Laboratory: multimedia presentation and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic
Dobski, T.: Combustion Gases in Modern Technologies, 2scd Ed., Wydawnictwo Politechniki Poznańskiej

Warnatz J., Maas U., Dibble R.W.: Combustion, Sprinter-Verlag, Berlin?Heidelberg 1999
Dobski T.: Spalanie gazów ziemnych o dużej zawartości azotu w urządzeniach przemysłowych, Wydawnictwo Politechniki Poznańskiej, Poznań 2001
Jarosiński J.: Techniki czystego spalania, WNT, Warszawa 1996
Molenda J.: Gaz ziemny. Paliwo i surowiec, WNT, Warszawa 2004
Wolfgang trier: Glass Furnaces, Design Construction and Operation,
Ecbert: Laser Diagnostic for combustion processes
Thierry Poinsot: Theoretical and numerical combustion
John Carrol:Natural Gas Hydrates
Andrzej Kowalkiewicz: Podstawy procesów spalania
Józef Jarosiński: Techniki czystego spalania
Additional
Glassman I.: Combustion, Academic Press, New York 1977,
Wilk R.K.: Low-emission Combustion, Wydawnictwo Politechniki Śląskiej, Gliwice 2002
Kowalkiewicz podstawowy procesów spalania, WNT, Warszawa 2000

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	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)	30	1,00