GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Boilers, PG_00055939		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Zakład Systemów i Urządzeń Energetyki Cieplnej -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Barański	
	Teachers	dr hab. inż. Jacek Barański dr inż. Marcin Jewartowski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	0.0	0.0	45
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	45	6.0	49.0	100

Subject objectives	The aim of the course is to acquire knowledge by students related to the determination of basic quantities for power boilers and the course of the combustion process occurring in these devices, especially in the area of the combustion chamber. They analyze and interpret the operation of a power boiler and the combustion process. They carry out balance tests of incineration devices. They distinguish and classify types of boilers and auxiliary equipment. They distinguish modern combustion techniques.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W06] knows classic and developmental energy technologies, rules for the selection and operation of heat and energy devices and installations, basic principles of energy systems operation, basic issues regarding the reliability of energy devices and diagnostics, environmental effects of energy technologies used, methods of using renewable energy sources	The student knows the classic and developmental energy technologies, the principles of selection and operation of thermal and energy equipment and installations, the basic principles of the operation of energy systems, the environmental effects of the energy technologies used.	[SW1] Assessment of factual knowledge
[K6_U08] can design the basic parameters of the selected technology related to energy conversion and select auxiliary devices and evaluate the project in terms of technical and economic	The student is able to design the basic parameters of the selected technology related to energy conversion and select auxiliary devices and assess the project in technical terms.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W09] knows the dangers of electrical devices and the principles of protection against them, has basic knowledge of heat exchangers, has basic knowledge of power equipment such as pumps, compressors, turbines, combustion engines, boilers, pipelines and their accessories and methods of their selection depending on the needs	The student has basic knowledge of power equipment such as boilers, pipelines and their accessories and methods of their selection depending on the needs.	[SW1] Assessment of factual knowledge

Subject contents

Lacture:

Basic concepts, schematic diagram, mass and heat balance. Components of the boiler device and its characteristics. Actual course of steam generation in h-p diagrams. Designing boiler equipment, preliminary design, setting assumptions, parameters, type of boiler. Boiler fuels, working composition, fuel properties and standards, calorific value. High and low temperature corrosion. Combustion processes, incomplete and incomplete combustion. Combustion air requirement, composition, quantity and properties of flue gases, H-t diagram for flue gases, adiabatic combustion temperature. Furnace, grate, dust, oil, gas and fluid bed furnaces. Fuel preparation devices, characteristic quantities, calculation of combustion chambers. Boiler efficiency and heat losses. Efficiency determination methods. Mechanisms of formation of gaseous toxic components of nitrogen, sulfur and carbon (NOx, SOx, COx). Low emission combustion technologies.

Exercises:

Calculations related to combustion processes in combustion chambers of engines, steam boilers, metallurgical and metallurgical furnaces. Calculation of the air requirement needed for combustion.

Laboratory:

Determination of boiler efficiency by direct and indirect method. Technical exhaust gas analysis, laboratory, industrial and automatic devices installed in the CHP plant. Determination of the catalytic reactor conversion rate in the gasoline internal combustion engine system. The use of a water table for 2D simulation of boiler operation.

Prerequisites and co-requisites	Mathematics Physics Thermodynamics Chemistry Fluid mechanics Heat transfer

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written test	56.0%	15.0%
laboratory report	56.0%	15.0%
written exam	56.0%	70.0%

Recommended reading

Basic literature	1. Piotrowski W.: Okrętowe kotły parowe, Wyd. PG, Gdańsk 1974 2. Piotrowski W.: Wytwornice pary, projektowanie i obliczenia cieplne, Wyd. PG 1977 3. Wróblewski T.: Urządzenia kotłowe, WNT, Warszawa 1973 4. Rokicki H.: Urządzenia kotłowe, przykłady obliczeniowe, Wyd. PG 1996 5. Wójcicki S.: Spalanie, WNT, Warszawa 1969 6. Chomiak J.: Combustion - a study in theory, fact and application, Abacus Press 1990 7. Kordylewski W.: Spalanie i paliwa, WPW, Wrocław 2002
Supplementary literature	1. Rayaprolu K.: Boilers for Power and processes; CRC Press 2009 by Taylor & Francis Group 2. Orłowski P.: Kotły parowe, konstrukcja i obliczenia, WNT, Warszawa 1979
eResources addresses	Adresy na platformie eNauczanie: Kotły energetyczne, W/C/L, E, sem.6, letni 24/25 - Moodle ID: 44860 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=44860

Example issues/ example questions/ tasks being completed	Elements of the boiler device Efficiency determination methods Flow of water and steam in the boiler Low emission combustion techniques

Work placement	Not applicable

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