GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Boilers, boiler installations and clean combustion technology (WM), PG_00042084						
Field of study	Power Engineering						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	English			
Semester of study	6		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Division of Thermal Power Systems -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jacek Barański				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	30
	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	30		5.0	65.0	100	
Subject objectives	The aim of the subject is the acquisition by the student of knowledge related to the determination of the basic informations for industrial boilers and combustion process occurring in these devices, particularly in the zone of furnace chamber. They analyse and interpret for boiler operation and combustion process. They carry out research of combustion appliances. Differentiate and classify types of boilers and auxiliary equipment. Distinguish modern combustion techniques.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W17] has an elementary knowledge on land mechanics, ground science, land reclamation and geotechnics; has basic knowledge about the composition of air, water and soil, environmental pollution and processes responsible for their formation and ways to reduce them, student knows the principles and organization of sustainable resource management within a circular economy	Student has elementary knowledge about the composition of air, water and soil, environmental pollutants and the processes responsible for their formation and ways to reduce them.	[SW3] Assessment of knowledge contained in written work and projects
[K6_U09] knows and applies the basic provisions of construction law, water law and environmental law; can determine the impact of construction investments on the environment	Student knows and applies basic standards and regulations of environmental protection law.	[SU2] Assessment of ability to analyse information
[K6_W14] has a theoretical knowledge in the field of chemistry, biology, physics and mathematics including knowledge necessary to understand the technological processes related to water treatment, wastewater treatment, waste management in energy facilities, circular economy	Student has structured and theoretically based knowledge in the field of chemistry, biology, physics, and mathematics, including the knowledge necessary to understand technological processes related to sewage treatment, waste management in energy facilities, and closed loop economy.	[SW1] Assessment of factual knowledge
[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	Student has basic knowledge of heat exchangers, has basic knowledge of energy devices such as boilers, pipelines and their accessories.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture
LECTURE
Basic concepts, schematic diagram, and thermal mass balance. The components of boilers unit and its describe quantities. The actual mileage steam generation in h-p chart. Fuel boiler, composition, properties and standards, fuel calorific value. High- and low-temperature corrosion. Combustion processes, incomplete and imperfect combustion. Furnace devices, grate-firing, pulverized-fired, oil, gas and fluidized combustion chamber. Equipment for fuel preparation. Boiler efficiency and heat losses. Methods for determining the efficiency, real and calculated fuel consumption, balance in exhaust gases and water side.

SEMINAR
The balancing rules for combustion devices.
Generation of gaseous toxic components like nitrogen, sulphur and carbon (NOx, SOx, COx).
Methods of reducing emissions of harmful substances generating from the incineration process energy devices.

Prerequisites and co-requisites

Basic knowledge of subjects: thermodynamics, fluid mechanics, chemistry and heat transfer.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	60.0%	70.0%
Practical exercise	100.0%	30.0%

Recommended reading

Basic literature	**Basic literature** 1. Orłowski P.: Kotły parowe, konstrukcja i obliczenia, WNT, Warszawa 1979 2. Piotrowski W.: Okrętowe kotły parowe, Wyd. PG, Gdańsk 1974 3. Piotrowski W.: Wytwornice pary, projektowanie i obliczenia cieplne, Wyd. PG 1977 4. Wróblewski T.: Urządzenia kotłowe, WNT, Warszawa 1973 5. Rokicki H.: Urządzenia kotłowe, przykłady obliczeniowe, Wyd. PG 1996 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	No requirements
eResources addresses	

Example issues/ example questions/ tasks being completed	Elements of boiler equipment Methods for determining the efficiency of the boiler The flow of water and steam in the boiler The low-emission combustion technologies
Practical activites within the subject	Not applicable

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