GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Boilers, Boiler Plants and Clean Combusion Technology, PG_00042135		
Field of study	Power Engineering, Power Engineering, Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	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	30.0	15.0	15.0	0.0	0.0	60
	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	60	6.0	9.0	75

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_W11	The student has knowledge of the known technologies and non-technical aspects to solve simple engineering tasks in the field of energy systems and devices.	[SW1] Assessment of factual knowledge
K6_U08	The student is able to 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 requirements.	[SU3] Assessment of ability to use knowledge gained from the subject
K6_W12	The student has basic knowledge of the life cycle and repairs of energy equipment in the field of thermal power plants, thermal and energy and heating systems, internal combustion engines, compressors and rotating machines.	[SW1] Assessment of factual knowledge
K6_W13	The student has basic knowledge of the operation of energy devices in the field of power plants, energy and heating systems, internal combustion engines, compressors and rotating machines. Has got basic knowledge of the regulation of energy devices and methods of their selection depending on the requirements.	[SW1] Assessment of factual knowledge

Subject contents

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. Combustion air requirement, composition, quantity and properties of flue gases, chart H-t for exhaust gases, adiabatic combustion temperature. Furnace devices, grate-firing, pulverized-fired, oil, gas and fluidized combustion chamber. Equipment for fuel preparation, the characteristic quantities, calculating combustion chambers. Boiler efficiency and heat losses. Methods for determining the efficiency, real and calculated fuel consumption, balance in exhaust gases and water side.

Introduction of students about basics of combustion thermodynamics and kinetics of process and occurring during process physicochemical phenomena. There are presented balancing rules for combustion devices, creation mechanisms of gaseous toxic components like nitrogen, sulphur and carbon (NOx, SOx, COx). The combustion process of energy devices is descibed. The principles for such processes in the most environmentally friendly (ecological) way and optimal energy are included. Methods of reducing emissions of harmful substances generating from the incineration process energy devices are presented.

LABORATORY
Determination efficiency of boiler by directly and indirectly method. Technical analysis of flue gases, laboratory, industrial and automatic apparatus installed in heating plants. The automatic, pneumatic, hydraulic and electrical controls. Use the water table to simulate the boiler operation.

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
Practical exercise	100.0%	30.0%
Midterm colloquium	60.0%	70.0%

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	Adresy na platformie eNauczanie:

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
Work placement	Not applicable