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, 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	
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	Department of Energy and Industrial Apparatus -> 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	

Lesson types and methods of instruction

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_U05	The student is able to formulate and solve simple energy balances in devices and energy systems.	[SU3] Assessment of ability to use knowledge gained from the subject
K6_U01	The student is able to obtain information from literature and other sources, organize, interpret it and draw and formulate conclusions; has the ability to self-study, the results of engineering tasks, speaks English at the B2 level.	[SU4] Assessment of ability to use methods and tools
K6_W06	The student knows the classic and developmental energy technologies, the principles of the selection and operation of thermal and energy devices and installations, the basic principles of the operation of energy systems, the environmental effects of energy technologies used, methods of using renewable energy sources.	[SW3] Assessment of knowledge contained in written work and projects

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. The design of boiler equipment, initial project, establish assumptions, parameters, type boiler. 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. 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	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	