GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Polygeneration systems, PG_00057256		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Ogrzewnictwa, Wentylacji, Klimatyzacji i Chłodnictwa -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jan Wajs	
	Teachers	dr inż. Paweł Ziółkowski dr inż. Waldemar Targański dr hab. inż. Jan Wajs	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	15.0	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	5.0	25.0	75

Subject objectives	The aim of the course is to present the construction and application of high-efficiency polygeneration energy systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W10] knows the basic installations of advanced energy systems, transmission networks and internal installations and their impact on the environment	The student knows the impact of energy technologies on the environment and is able to identify ways to reduce pollution.	[SW1] Assessment of factual knowledge
[K7_W08] as knowledge about development trends in the field of known technologies and non-technical aspects to solve simple engineering tasks in the field of power systems and equipment or transmission networks and internal installations	The student knows the technology of modern combined energy systems and is able to assess the applicability of different technologies in the energy system.	[SW1] Assessment of factual knowledge
[K7_W07] knows the environmental effects of energy technologies used; is familiar with the issues of effective energy management and use of renewable energy sources, has a broad and well-established knowledge of the processes of energy production and use	The student knows the structure of combined energy systems. He can choose energy sources (renewable and conventional) and design systems of waste energy recovery.	[SW1] Assessment of factual knowledge
[K7_U06] is able to apply basic and advanced knowledge of power equipment and transmission network and internal installations to the preliminary design of a modern power plant or part thereof	The student knows the issues of energy conversion systems in combined energy systems associated. The student can optimize the selection of energy sources and energy products.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information

Subject contents	Lecture: Combined production of electricity, heat, cold and other products intended for use in power plants. Co-energy processes. Optimized operation of polygeneration systems with electric power network and municipal heating grid. Cogeneration and trigeneration in chp systems. Polygeneration systems based on technologies using natural gas, biogas technology, biomass technology, Organic Rankine Cycle (ORC)technology, fuel cell technology. Use of steam and gas turbines, steam-gas systems, internal combustion engines in chp systems. Systems and equipment used for waste heat recovery. Accumulation of heat in district heating systems. The primary energy sources savings and reducing environmental pollution. Mechanisms to promote the development of polygeneration systems. Laboratory: Laboratory using software for modeling of combined thermodynamic cycles. Knowledge of principles of heat balance determining of energy sources. Knowledge of the principles of building waste heat recovery systems. The practical ability to determine quantity and power of key elements of power systems: power and heat sources, heat exchangers, pumps, valves, etc. Seminar: Individual student"s work related to the collection and analysis of information about selected poligeneration system (technical description, prinicples of operation, characteristics, economical and ecological data), which are presented and evaluated during the seminar.
Prerequisites and co-requisites	Thermodynamics, Machine design, Heat transfer

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written assessment of the lecture	56.0%	50.0%
laboratory	56.0%	30.0%
seminar	56.0%	20.0%

Recommended reading

Basic literature	1. Skorek J., Kalina J.: Gazowe układy kogeneracyjne. Wydawnictwa Naukowo-Techniczne 2005. 2. Skorek J.: Ocena efektywności energetycznej i ekonomicznej gazowych układów kogeneracyjnych małej mocy" Wydawnictwo Politechniki Śląskiej. Gliwice 2002. 3. Szargut J., Ziębik A.: Skojarzone wytwarzanie ciepła i elektryczności elektrociepłownie. Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego 2007. 4. Chmielniak T., Chmielniak T.: Energetyka wodorowa, Wyd. PWN, Warszawa 2020.
Supplementary literature	1. Marecki J. Gospodarka skojarzona cieplno-elektryczna. WNT, Warszawa, 1980. 2. Chmielniak T.: Technologie energetyczne. WNT, Warszawa 2008.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	The term of co generation and trigeneration. Distributed energy systems. Design and use of the combined energy systems. Bio-fuels in the combined energy systems. Waste heat recovery.
Work placement	Not applicable