GDAŃSK UNIVERSITY
OF TECHNOLOGY

Subject card

Subject name and code	Polygeneration systems, PG_00064742		
Field of study	Power Engineering		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
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	Division of Heating Ventilation Air Conditioning and Refrigeration -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jan Wajs	
	Teachers		

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	15.0	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	10.0	20.0	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_U04] creatively designs or modifies, either entirely or at least in part, energy systems, machines and devices, transmission grids and internal installations, considering both technical and non-technical aspects, estimating costs and utilizing design techniques appropriate for tasks within the scope of Power Engineering	develops concepts for improving the efficiency of energy conversion in the system	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K7_W03] demonstrates structured and theory supported knowledge encompassing key issues in the field of Power Engineering, enabling design of energy systems, machines and devices, transmission grids and internal installations	explains the technology of modern combined energy systems, verifies the applicability of different technologies in the energy system	[SW1] Assessment of factual knowledge
[K7_U03] identifies and formulates task specifications in the scope of energy systems, machines and devices, transmission grids, buildings and internal installations	identifies opportunities for optimizing a polygeneration system	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W01] explains and describes, based on general knowledge in the field of scientific disciplines forming the theoretical foundations of Power Engineering, the structure, principles of operation and evironmental impact of energy systems, machines and devices, transmission grids and internal installations	knows the impact of energy technologies on the environment and is able to identify ways to reduce pollution	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Lecture: Combined production of electricity, heat, cold and other products intended for use in power plants. Coenergy 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. The primary energy sources savings and reducing environmental pollution.
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.
Project: Solution of the design task within the given scope. Presentation of the results.

Prerequisites and co-requisites

Thermodynamics, Machine design, Heat transfer

Assessment methods and criteria

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

Recommended reading

Basic literature	Amidpour M., Manesh M.H.K.: Cogeneration and Polygeneration Systems, Elsevier Science Publishing Co INC International Concepts, 2020.
Supplementary literature	Hani M.R.: et al.: An overview of polygeneration as a sustainable energy solution in the future. Journal of Advanced Research in Fluid Mechanics and Thermal Sciences, vol. 74 (2020), doi:10.37934/arfmts. 74.2.85119
eResources addresses	

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.

Work placement

Not applicable

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