



Subject card

Subject name and code	Polygeneration systems, PG_00064742						
Field of study	Power Engineering						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2024/2025		
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 hab. inż. Jan Wajs dr inż. Paweł Ziółkowski				
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_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 environmental 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
	[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	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
	[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_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	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
Subject contents	<i>Lecture:</i> 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. <i>Laboratory:</i> 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. <i>Project:</i> 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
	laboratory	56.0%	20.0%
	written assessment of the lecture	56.0%	50.0%
	project	56.0%	30.0%
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	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.		
Work placement	Not applicable		

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