GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical modelling of energy plants, PG_00064745					
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		4.0	
Learning profile	general academic profile		Assessment form		assessment	
Conducting unit	Zakład Systemów i Urządzeń Energetyki Cieplnej -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology					
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Ziółkowski			
	Teachers		dr inż. Stanisław Głuch dr inż. Paweł Ziółkowski			
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	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	45.0	100	
Subject objectives	Present the issues of mathematical modeling of power plants, including thermodynamic cycles and selected power plant equipment using numerical codes, so that the Student is able to properly model the process and interpret the results.					

Learning outcomes	(see table below)

Course outcome	Subject outcome	Method of verification
[K7_U02] formulates and tests hypotheses concerning problems related to energy conversion processes, their efficiency, control, safety and impact on the environment, as well as simple research problems	formulates and tests hypotheses related to problems of energy conversion processes, their efficiency, control, safety and environmental impact, as well as simple research problems involving classical and alternative solutions for electricity production	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W04] demonstrates knowledge encompassing selected issues in the field of advanced detailed knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Power Engineering	demonstrates knowledge covering the issues of mathematical modeling by design (0D) and detailed field analyses using geometry (2D and 3D), in particular, in the field of methods, techniques, tools and algorithms specific to the Power Engineering, including the design, analysis and optimization of fluid-flow machines and heat exchangers	[SW1] Assessment of factual knowledge
[K7_U01] utilizes acquired analytical, simulation, and experimental methods, as well as mathematical models for analysis and evaluation of energy systems, machines and devices, transmission grids and internal installations	has knowledge of mass and heat transfer processes using available numerical tools. Uses computational software applications with the selection of appropriate mathematical models to analyze and evaluate systems, power machines and equipment, transmission networks and internal installations	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K7_W02] demonstrates structured and theory supported knowledge encompassing key issues in the field of Power Engineering, enabling modeling and analysis of energy systems, machines and devices, transmission grids and internal installations	demonstrates a structured knowledge of mathematical modeling with a theoretical foundation relating to the physics of the process, covering the key issues in the field of Power Engineering allowing the modeling and analysis of energy systems, machinery and equipment, transmission networks and internal installations, including those based on classical and alternative energy sources	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	To repeat and expand information on thermodynamic cycles. Expand information on their modeling using 0D and 3D commercial tools. Presentation of balances, constitutive equations, how to set conditions in CFD-type codes. Regulation and control of equipment in the context of heat exchangers.
Prerequisites and co-requisites	Mathematics, physics, fluid mechanics and thermodynamics
Assessment methods and criteria	(see table below)

Subject passing criteria	Passing threshold	Percentage of the final grade
Credit lecture in written form	56.0%	60.0%
Credit for the project in the form of a paper from the completed task or a presentation	56.0%	40.0%

Recommended reading	Basic literature	Olgierd C. Zienkiewicz (1972): Metoda elementów skończonych. Arkady, Warszawa. Janusz Badur, Pięć wykładów ze współczesnej termomechaniki płynów. 2005 Gdańsk. https://www.imp.gda.pl/fileadmin/doc/o2/z3/publications/2005_piecwykladow.pdf P. Madejski i P. Żymełka: Wprowadzenie do komputerowych obliczeń symulacji pracy systemów energetycznych w programie Steag Ebsilon. Wydawnictwo AGH

	Supplementary literature	Stephen Turns: Thermal-Fluid Sciences an integrated approach. Cambrige University Press, New York 2006. Wolfgang Altmann: Practical process control for engineers and technicians. Newnes, Oxford 2005. Rolf Kehlhofer: Combined-cycle gas & steam turbine power plant. The Fairmont Press, Lilburn, 1991.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Mass, momentum, and energy balances in 0D and 3D terms.	
Work placement	Not applicable	