GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical modelling of energy plants, PG_00064745		
Field of study	Power Engineering, Power Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
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	Division of Thermal Power Systems -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jerzy Głuch	
	Teachers	prof. dr hab. inż. Jerzy Głuch mgr inż. Kamil Stasiak	

Lesson types	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

Course outcome	Subject outcome	Method of verification
[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
[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

Subject contents

Course content – lecture

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

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	
Example issues/ example questions/ tasks being completed	Mass, momentum, and energy balances in 0D and 3D terms.	
Practical activites within the subject	Not applicable	

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