



Subject card

Subject name and code	Basic thermodynamic analysis in energy conversion processes, PG_00060863						
Field of study	Podstawy analiz termodynamicznych w procesach przetwarzania energii						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	first-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	2		Language of instruction		Polish		
Semester of study	4		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Energy Conversion and Storage -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Ewa Klugmann-Radziemska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		2.0		18.0	50
Subject objectives	To familiarize students with energy conversion processes, measurement and calculation methods, and the basics of thermodynamic analysis.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W04] Possesses the technical knowledge necessary to analyze processes and design installations in the chemical industry.		has knowledge of technical thermodynamics and chemical engineering necessary to analyze technological processes and properly design installations and systems in the chemical industry		[SW1] Ocena wiedzy faktograficznej		
	[K6_W01] Possesses knowledge of mathematics and physics necessary to analyze and describe technological processes, including differential and integral calculus, numerical methods, statistics and elements of vector analysis.		performs basic calculations of the energy balance of phenomena and devices; performs calculations of individual and project processes		[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym		

Subject contents	Course content – lecture analysis of heat exchange issues (conduction, convection, absorption, penetration) and conversion of thermal energy into other types of energy in devices and their efficiency.Contents: 1. Basic concepts and the ability to apply them 2. Basic concepts of general thermodynamics: internal energy, thermodynamic state, state function, process function, thermodynamic potentials, pressure, temperature, volume, heat, specific heat, enthalpy, entropy, exergy, thermodynamic system, thermodynamically isolated system. 3. Principles of thermodynamics. Classification of thermodynamic processes. 4. Technical thermodynamic calculations. Real and ideal and semi-perfect gases. 5. Temperature scales. Equivalence of the thermodynamic temperature scale and the temperature scale of an ideal gas, absolute temperature scale. 6. Methods of measuring temperature 7. Characteristic processes of semi-perfect gases. Thermodynamic cycles. Carnot engine, Carnot engine efficiency 8. Clausius-Rankine cycle - conventional or nuclear steam power plants, chillers and heat pumps 9. Otto cycle - spark-ignition piston internal combustion engines 10. Atkinson engine - increasing the expansion ratio regarding the Otto cycle 11. Diesel cycle 12. Seiliger-Sabathé cycle - high-speed diesel engine with injection pump 13. Brayton-Joule cycle - gas turbine 14. Joule refrigeration cycle 15. Heat exchange by radiation 16. Heat exchange by conduction 17. Heat exchange by convection 18. Principles of thermal insulation efficiency 19. Theory of similarity and dimensional analysis		
	Course content – laboratory 1. Determination of the thermal conductivity coefficient of building materials 2. Determination of the heat of combustion of fuels using a calorimeter 3. Determining the efficiency of a heat exchanger 4. Determining the efficiency of a heat pump 5. Determining the characteristics of a fuel cell 6. Determining the efficiency of a wind generator 7. Calculating the efficiency of a solar collector.		
Prerequisites and co-requisites	Passed mathematics and physics courses as required by the study program		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Labs Passed, Written test	60.0%	100.0%
Recommended reading	Basic literature	A. Ziębik, M. Szega, W. Stanek; Efektywność Energetyczna iEkologiczna. Poradnik Metodyczny w Zakresie Analiz Termodynamicznych i Termoeologicznych; Wydawnictwo Politechniki Śląskiej 2022, ISBN: 978-83-7880-791-9 S. Postrzednik, Z. Żmudka; Termodynamiczne oraz ekologiczne uwarunkowania eksploatacji tłokowych silników spalinowych, ISBN: 978-83-7335-421-0, Wydawnictwo Politechniki Śląskiej 2007 J. Szargut, Termodynamika, Wydawnictwo Naukowe PWN Warszawa 2022, Wydanie: 7 Klugmann-Radziemska E., Termodynamika Techniczna, Wyd. Politechniki Gdańskiej 2016 Wiśniewski S: Termodynamika techniczna, Warszawa WNT Wyd. 7.,2022 Pudlik W.: Termodynamika, Wydawnictwo Wyd. Politechniki Gdańskiej 2022	
	Supplementary literature	Klugmann-Radziemska E., Odnawialne źródła energii. Przykłady obliczeniowe, Wyd. IX, Wydawnictwo Politechniki Gdańskiej, 2021	
	eResources addresses		
Example issues/ example questions/ tasks being completed	A detached house with a usable area of 140 m2 and an energy consumption index of 150 kWh/(m2.year) is heated by a ground heat pump with an efficiency coefficient of4. Calculate the required electrical power of the heat pump		
Practical activites within the subject	Not applicable		

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