



Subject card

Subject name and code	Technical Thermodynamics, PG_00035951						
Field of study	Chemical Technology						
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024				
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	3	ECTS credits	3.0				
Learning profile	general academic profile	Assessment form	exam				
Conducting unit	Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Anna Kuczyńska-Łażewska					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	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	5.0	40.0	75		
Subject objectives	To familiarize students with the basics of technical thermodynamics, linking concepts and relationships of the thermodynamic properties of substances and technical applications.						
Learning outcomes	Course outcome	Subject outcome	Method of verification				
	K6_W04	understands the basic processes involving heat exchange and energy transport in physical phenomena and technical devices	[SW1] Assessment of factual knowledge				
	K6_U04	performs basic calculations of the energy balance of phenomena and devices; performs calculations of unit and design processes	[SU1] Assessment of task fulfilment				

Subject contents	<p>Technical thermodynamics deals with the analysis of heat transfer (conduction, convection, transfer, transfer) and the conversion of thermal energy into other types of energy in thermal machines.</p> <ol style="list-style-type: none"> 1. Basic concepts and the ability to use 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. Laws of thermodynamics. Classification of thermodynamic processes. 4. Technical thermodynamic calculations. Real gases and ideal and semi-perfect gases. 5. Temperature scales. Equivalence of the thermodynamic temperature scale and the ideal gas temperature scale, absolute temperature scale. 6. Temperature measurement methods 7. Characteristic transformations of semi-ideal 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 - internal combustion engines with spark ignition 10. Atkinson engine - increasing the expansion ratio for 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 transfer by radiation 16. Heat transfer by conduction 17. Heat transfer by convection 18. Similarity theory and dimensional analysis 19. Thermodynamics of combustion. 											
Prerequisites and co-requisites	mathematics, physics											
Assessment methods and criteria	<table border="1" data-bbox="453 1865 1485 1960"> <thead> <tr> <th data-bbox="453 1865 794 1899">Subject passing criteria</th> <th data-bbox="794 1865 1139 1899">Passing threshold</th> <th data-bbox="1139 1865 1485 1899">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 1899 794 1933">midterm colloquium</td> <td data-bbox="794 1899 1139 1933">60.0%</td> <td data-bbox="1139 1899 1485 1933">50.0%</td> </tr> <tr> <td data-bbox="453 1933 794 1966">egzam</td> <td data-bbox="794 1933 1139 1966">60.0%</td> <td data-bbox="1139 1933 1485 1966">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	midterm colloquium	60.0%	50.0%	egzam	60.0%	50.0%
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Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Klugmann-Radziemska E., Termodynamika Techniczna, Wyd. PG 2009 2. Wiśniewski S: Termodynamika techniczna, Warszawa WNT 1987 3. Staniszewski B.: Termodynamika, PWN 1982 4. Pudlik W.: Termodynamika, Wydawnictwo PG 1998 5. Gumiński K: Termodynamika, PWN 1982
	Supplementary literature	<ol style="list-style-type: none"> 1. Kalinowski E.: Termodynamika, PW Wrocław, 1994 2. Szarawara J.: Termodynamika Chemiczna, WNT 1985 3. Michałowski S, Wańkiewicz K.: Termodynamika procesowa, WNT 1993
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	