



Subject card

Subject name and code	Thermodynamics, PG_00063340						
Field of study	Nanotechnology						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Strongly Correlated Electronic Systems -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Winiarski					
	Teachers	dr inż. Michał Winiarski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	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		5.0		50.0	100
Subject objectives	The aim of the course is to familiarize students with the basics of thermodynamics, with a particular emphasis on their application in materials engineering.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W03] has systematic knowledge within the scope of all branches of general physics (mechanics and study of heat, electricity and magnetism, waves, optics, elements of modern physics).	The listed branches of general physics are covered in other courses; in the current course, their thermodynamic aspects are emphasized.			[SW1] Assessment of factual knowledge		
	[K6_U02] can analyze and solve simple scientific and technical problems based on possessed knowledge, applying analytical, numerical, simulation and experimental methods.	The student is able to calculate the basic thermomechanical properties of phases based on given equations of state.			[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		
	[K6_W05] has knowledge of inorganic and organic chemistry, physical chemistry and chemical thermodynamics.	The student is able to apply the principles of thermodynamics and perform simple calculations to explain the mechanism of chemical reactions.			[SW1] Assessment of factual knowledge		

Subject contents	<ul style="list-style-type: none"> • Introduction: Definitions of state and process functions, thermodynamic potentials, specific heat • Equation of state: Ideal gas and its properties • Solids and liquids • Thermodynamic equilibrium • Microstate and macrostate. Entropy • Einstein model and Debye model. Thermodynamic properties of crystals • Phase equilibrium in single- and multi-component systems • CALPHAD 		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final exam on the second part of the lecture at the end of the semester	50.0%	33.0%
	Mid-term exam on the lecture part	50.0%	33.0%
	Calculation exercises test	50.0%	34.0%
Recommended reading	Basic literature	<ul style="list-style-type: none"> • S.J. Ling, W. Moebs, J. Sanny. <i>University Physics Vol. 2</i>. OpenStax, 2016 	
	Supplementary literature	1. Ch. Schiller. <i>Motion Mountain: The adventure of physics - vol. 1</i> . Ed. 31. Available on-line: https://www.motionmountain.net/online.html	
	eResources addresses	Podstawowe http://hyperphysics.phy-astr.gsu.edu/hbase/heacon.html#heacon - Rozdział "Heat and Thermodynamics" w podręczniku Hyperphysics Uzupełniająca Adresy na platformie eNauczanie: Termodynamika 2024/25 - Moodle ID: 45205 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=45205	
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> • Provide the assumptions and basic conclusions of the Debye model. • Explain the factors that may cause deviations of real gas behavior from the ideal gas model. 		
Work placement	Not applicable		

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