GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical Chemistry of Real Systems, PG_00045465		
Field of study	Chemical Technology		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2021/2022
Education level	second-cycle studies	Subject group	Optional subject group 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	5.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Maciej Śmiechowski	
	Teachers	dr hab. inż. Maciej Śmiechowski dr hab. inż. Adam Kloskowski	

Lesson type and method of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	15.0	0.0	15.0	0.0	75
	E-learning hours included: 0.0						
	Fizykochemia układów rzeczywistych 2022 - Moodle ID: 20970 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=20970						

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	75	10.0	40.0	125

Subject objectives	The aim of the subject is to familarize the students with selected problems of advanced physical chemistry and their applications as well as teaching them skills needed for solving such problems in a computational manner.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K7_W05	Student can collect suitable literature and numerical data as well as plan his/her own algorithm of solving a problem from the area of advanced thermodynamics.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
	K7_U06	Student can analyze open systems, work using real gas models and calculate chemical equilibria using thermodynamic constants instead of the simplified ones.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	LECTURES Thermodynamics: real gas models. Practical utilization of the principle of corresponding states for estimation of thermodynamic functions of gases and their mixtures. Generalized graphs. Advanced undetsranding and uilization of the kinetic theory of gases. Thermodynamics of open systems. Elements of statistical thermodynamics. Advanced theory of phase equilibria, Ehrenfest classification and equations. Analysis of phase diagrams. Criteria od phase equilibrium, metastable phases. Deeper understanding of cryoscopic and ebulioscopic effects. Liquid crystals. Advanced chemical kinetics: tranmsport properties of gases and liquids, derivation and integration of complex rate laws. Advanced electrochemistry: equivalent electrical circuits, concentration cells with ionic transport, ion transfer numbers and ionic structure of electrolytes in solutions. Butler-Volmer equation; Tafel equation. HER mechanism. Assorted advanced electroanalytical methods. PROJECT Calculations in advanced chemical thermodynamics. Independent solution of a numerical project using VBA language. TUTORIALS Calculations in real gas thermodynamics. Preperation and multimedia presentations of assorted problems complementary to the lecture contents and/or presenting theoretical background of calculation methods and algorithms used in tutorials.
Prerequisites and co-requisites	BSc level diploma in chemistry or related studies

Assessment methods and criteria			
	Subject passing criteria	Passing threshold	Percentage of the final grade
	performing theoretical calculations	50.0%	30.0%
	problem solving test + multimedia presentation	50.0%	30.0%
	final test in lectures	50.0%	40.0%

Recommended reading	Basic literature	1. P. W. Atkins, Chemia fizyczna, PWN 2001. 2. P. W. Atkins, Podstawy chemii fizycznej, PWN 1999. 3. P. W. Atkins, Przewodnik po chemii fizycznej, PWN 1997. 4. K. Pigoń i Z. Ruziewicz, Chemia fizyczna, PWN 2006.
	Supplementary literature	All the books belonging to the "Wykłady z chemii fizycznej" series by WNT, Warszawa. 1. H. Buchowski i W. Ufnalski, Podstawy termodynamiki 2. H. Buchowski i W. Ufnalski, Fizykochemia gazów i cieczy 3. H. Buchowski i W. Ufnalski, Gazy, ciecze i płyny 4. H. Buchowski i W. Ufnalski, Roztwory 5. W. Ufnalski, Równowagi chemiczne 6. H. Buchowski, Elementy termodynamiki statystcznej 7. A. Molski, Wprowadzenie do kinetyki chemicznej 8. A. Kisza, Elektrochemia. Jonika 9. A. Kisza, Elektrochemia. Elektrodyka
	eResources addresses	

Example issues/ example questions/ tasks being completed	Prove that the van der Waals equation is a cubic equation of state. What is the fugacity coefficient? How to determine it from the compressibility factor? What is the Boyle temperature? Define its relationship with the second viral coefficient and describe its physical sense. Find the Boyle temperature of the van der Waals gas. What does Graham's law of effusion state, and what are the conditions for its applicability? Three average velocities from the MaxwellBoltzmann distribution: definitions and relations. List the transport properties of fluids you know. For each of them, provide the transported quantity and the quantity which gradient is the driving force of the transport. The phenomenon of thermodiffusion: thermodynamic description and applications. Local equilibrium hypothesis. Discuss the influence of external pressure on the saturated vapor pressure of a pure substance. Discuss the reasons for the limited miscibility of the liquids and the reasons for the occurrence of the lower or upper critical temperature for a given liquid mixture. Define a hypercritical point. How is congruent melting different from incongruent melting in compounds formed in solid phase?
Work placement	Not applicable