GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00057786		
Field of study	Green Technologies		
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	English
Semester of study	4	ECTS credits	7.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Maciej Śmiechowski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	30.0	0.0	0.0	75

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	75	15.0	85.0	175

Subject objectives

The aim of the subject is familiarizing the students with basic concepts in electrochemistry, chemical kinetics and surface phenomena

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] has a basic knowledge of chemistry including general chemistry, inorganic, organic, physical, analytical, including the knowledge necessary to describe and understand the phenomena and chemical processes occurring in the environment; measurement and the determination of the parameters of these processes.	Student demonstrates knowledge of basic physicochemical laws and their applications in solving simple technological problems.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K6_U03] is able to use information and communication technologies relevant to the common tasks of engineering, is able to use known methods and mathematical-physical models to describe and explain phenomena and chemical processes	Student prepares tables and graphs necessary for analyzing independently carried out experiments, correctly estimates the accuracy and precision of experimental results and uses physicochemical databases.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Subject contents	Electrolyte solution. Theory of strong electrolytes. Activity coefficients. Electrical conductivity. Electrode-solution interface. Interfacial potentials. Electrodes and galvanic cells. Thermodynamics of galvanic cells. Electromotive force measurements. Practical aspects of potentiometry. The determination of pH. Standard reduction potentials. The electrochemical series. Electrode polarization. Electrolysis. Galvanic sources of energy. Corrosion. Chemical kinetics: basic concepts, rate laws and rate constants, reaction order, elementary and complex reactions. Complex reaction mechanisms. Homogeneous and heterogeneous catalysis. Enzymatic processes. Chain reactions. Explosion. Interfacial phenomena. Surface tension. Surfactants. Adsorption on liquid-gas interface. Gibbs adsorption isotherm. Characterization of colloidal particles. Structure of colloidal particle. Electrokinetic phenomena. Coalescence and coagulation. Adsorption on solid-gas interface. Langmuir isotherm. BET isotherm. Thermodynamic description of adsorption.
Prerequisites and co-requisites	Knowledge of mathematics, physics and inorganic chemistry at BSc level.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
2 written tests	50.0%	25.0%
carrying out 5 experiments and submitting the reports	100.0%	25.0%
written/oral exam	50.0%	50.0%

Recommended reading

Basic literature	1. P. W. Atkins, J.A.Beran, General Chemistry, Oxford University Press, any edition above 2nd. 2. P. W. Atkins, Physical Chemistry, Oxford University Press, any edition above 5th. 3. W.Chrzanowski et coll., lecture notes, lab manuals and text problems published in the web pages of the Department of Physical Chemistry
Supplementary literature	see e-links below: - http://www.freebookcentre.net/Chemistry/Physical-Chemistry-Books.html - Wide selection of textbooks, lecture notes and lab manuals in English
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

- Draw linearized plots of transformed concentration of reactant X vs. time for reactions of specified order. Clearly mark the axes, label the intercept and slope and write equations of all lines.
- The graph presents the conductometric titration curve for a weak base titrated by a strong acid. Write an example of such titration reaction and thoroughly explain the shape of the curve.
- The reaction A + B P is irreversible. On the basis of the data collected in the table on the reaction initial rate dependence on initial concentrations of reactants, determine partial order with respect to both reactants (A and B), total reaction order, and reaction rate constant (with units).
- Explain as precisely as possible the construction of the saturated calomel electrode, making an appropriate sketch, and describe its applications. Given the standard potentials, calculate the potential of the tin(IV)/tin(II) redox electrode vs SCE.
- On diagrams draw Langmuir isotherm and its linearized version. Label the axes. Demonstrate the procedure of linearization of Langmuir isotherm.
- A modified Szyszkowski equation was proposed for sodium alkyl phosphates in water. Derive the equations permitting the calculation of the surface excess and maximum surface excess for such solutions.

Work placement	Not applicable