GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Experimentarium III, PG_00068099		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
Education level	first-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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Ewa Wagner-Wysiecka	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	30.0	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	43.0	75

Subject objectives

The course provides a comprehensive and interdisciplinary introduction to analytical techniques used in the characterization of substances with therapeutic and diagnostic significance. The goal is to familiarize students with the potential applications of selected instrumental techniques and the use of dedicated software for analyzing and comparing experimental data.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student is able to apply their work experience to optimize experimental processes, also integrating devices and software in a way that ensures appropriate efficiency and accuracy of results; the student can design a simple measuring device, selecting appropriate techniques, materials, and analytical tools depending on the planned experiment.	[SU1] Assessment of task fulfilment
[K6_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	The student is able to analyze the operation of devices in laboratories and assess their effectiveness; uses acquired experience to optimize their functioning; collaborates in a team, proposing improvements in the operation of devices.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study	The student is able to use available software to analyze experimental data; can select appropriate IT tools for interpreting experimental results, considering the specifics of the substances being studied; and can plan experiments and analyze results using dedicated computer applications	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents

Course content – laboratory

After familiarizing themselves with the experimental methodology (exercises 1, 3, and 5), students plan the experiment (exercises 2, 4, and 6), conduct it, analyze, and verify the obtained results.

1. Determination of the molar refractive index of mixtures basics and significance 5h
2. Application of refractometric method in bioanalytical determinations (glucose in urine), development of a tool supporting data analysis 5h
3. Determination of the partition coefficient log K basics and significance 5h
4. Partition coefficient as a parameter characterizing therapeutic substances, determination of the partition coefficient of selected therapeutic substances, comparison of parameters with computational data (e.g. SwissADME) 5h
5. Characterization of complex formation equilibrium, determination of the stability constant of the complex using spectrophotometric method, comparison of classical numerical methods and application of dedicated software (OPIUM, Bindfit) 5h
6. Determination of the affinity of therapeutic substances to metal ions, using paracetamol as an example; use of ion analyzer; conductometric method and/or spectrophotometric method 5h

Prerequisites and co-requisites

The student should have basic knowledge of analytical chemistry, the ability to operate laboratory equipment, basic computer skills, and proficiency in analytical software, as well as the ability to analyze experimental data.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Completing all the exercises and passing the short tests	51.0%	45.0%
Preparing the report of the conducted experiments	51.0%	45.0%
Activity during the classes	100.0%	10.0%

Recommended reading

Basic literature

1. Ćwiczenia laboratoryjne z chemii fizycznej, red. J. Woźnicka, H. Piekarski, Wydawnictwo UŁ, Łódź 2005.

2. L. Sobczyk, A. Kisza A., K. Gatner K., A. Koll, Eksperymentalna chemia fizyczna, SGGW, Warszawa 2017.

3. K. Pigoń, Z. Ruziewicz, Chemia fizyczna, PWN, Warszawa, 2013.

4. P. Atkins, de P. Julio, J. Keeler, Chemia fizyczna, PWN 2022

5. I. Staneczko-Baranowska, B. Buszewski, Bioanalityka w nauce i życiu, t. 1 t.2, PWN 2020

6. J. Minczewski, Z. Marczenko, Chemia analityczna t. 1 i t.2 PWN, 2020

7. E.H., Evans, M.E. Foulkes, Chemia analityczna, PWN, 2020

8. R. Kocjan, Chemia analityczna, t 1 i t.2 , PZWL, 2014

9. P. Konieczka, J. Namieśnik, Ocena i kontrola jakości wyników pomiarów analitycznych, WNT, 2017

	Supplementary literature	1. R. Brdička, Podstawy chemii fizycznej, PWN, 1970 2. G. Barrow, Chemia fizyczna, PWN, Warszawa 1978 3. W. Tomassi, H. Jankowska, Chemia fizyczna, WNT, Warszawa 1980 4. S. Bursa, Chemia fizyczna, PWN, Warszawa 1979 5. A. Cygański, Chemiczne metody analizy ilościowej. PWN, WNT, 2019 6. P. Thordarson,. Determining association constants from titration experiments in supramolecular chemistry. *Chemical Society Reviews*. 22 luty 2011, T. 40, nr 3, s. 13051323. DOI 10.1039/C0CS00062K. 7. D.B. Hibbert, P. Thordarson, The death of the Job plot, transparency, open science and online tools, uncertainty estimation methods and other developments in supramolecular chemistry data analysis. *Chemical Communications*. 25 październik 2016, T. 52, nr 87, s. 1279212805. DOI 10.1039/C6CC03888C.
	eResources addresses	Basic http://supramolecular.org/ - Bindfit - software https://web.natur.cuni.cz/~kyvala/opium.html - OPIUM software http://www.swissadme.ch/ - SwissADME - online softwatre
Example issues/ example questions/ tasks being completed	**Task:** Determination of the molar refractive index of a mixture of two components. **Question:** How does the molar refractive index change depending on the ratio of components in the mixture? **Task:** Determination of the partition coefficient log K for a selected therapeutic substance using the solvent extraction method. **Question:** What is the significance of the partition coefficient value for the bioavailability and effectiveness of substances with therapeutic effects? **Task:** Measuring the affinity of paracetamol for metal ions using a spectrophotometric method. **Question:** What are the advantages and limitations of using the spectrophotometric method to study the interactions of substances with metals?	
Practical activites within the subject	Not applicable	

Document generated electronically. Does not require a seal or signature.