



## Subject card

Subject name and code	, PG_00037602						
Field of study	Green Technologies						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2024/2025		
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	4	Language of instruction			English English		
Semester of study	7	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Agata Kot-Wasik					
	Teachers	prof. dr hab. inż. Agata Kot-Wasik dr inż. Paweł Kubica prof. dr hab. inż. Andrzej Wasik dr hab. inż. Weronika Hewelt-Belka dr inż. Tomasz Majchrzak					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	15.0	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	3.0		47.0		125
Subject objectives	The aim of the course is to present issues in the field of classic and modern techniques for separating mixtures, taking into account aspects of green and white chemistry and sustainable technology management.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W03] has a basic knowledge of soil, air and water pollutants, design and supervision of environmentally friendly technologies and technologies which do not produce waste, knows technology of cleaning and neutralization of industrial waste and wastewater management, has a basic understanding of the theoretical basis of methods and types of apparatus used in chemical analysis of environmental pollutants	Student has a basic knowledge concerning separation techniques involved nowadays, for example in soil, air and water pollutants determination, design and supervision of environmentally friendly technologies.			[SW3] Assessment of knowledge contained in written work and projects		
	[K6_U05] can formulate and solve engineering tasks analytical methods, simulation as well as experimental, able to apply knowledge of basic physics and mathematics to analyze the results of experiments, is able to analyze and assess existing technical solutions	Student can formulate and solve engineering tasks analytical methods, simulation as well as experimental.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools		

Subject contents	<p>Theoretical basic of separation, extraction, chromatography and electromigration.</p> <p>Green and white chemistry.</p> <p>Pro-environmental technologies.</p> <p>Practical aspects of separation processes used in systems: gas-liquid, gas-solid, liquid-solid, liquid-liquid, solid-supercritical fluid. Extraction techniques (LLE, SPE, SPME, SFE).</p> <p>Filtration, centrifugation, absorption, adsorption, distillation, condensation, crystallization. Membrane techniques. Laboratory and industrial applications.</p> <p>Chromatographic techniques (GC gas chromatography, HPLC liquid chromatography, supercritical fluid chromatography) - theoretical basis, optimization of the chromatographic separation process, applications.</p> <p>Electromigration techniques.</p> <p>Hyphenated techniques.</p>														
Prerequisites and co-requisites	Basic knowledge of chemistry, mathematics and physics.														
Assessment methods and criteria	<table border="1" data-bbox="451 846 1487 992"> <thead> <tr> <th data-bbox="451 846 794 891">Subject passing criteria</th> <th data-bbox="794 846 1137 891">Passing threshold</th> <th data-bbox="1137 846 1487 891">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 891 794 925">Seminar</td> <td data-bbox="794 891 1137 925">60.0%</td> <td data-bbox="1137 891 1487 925">20.0%</td> </tr> <tr> <td data-bbox="451 925 794 958">Lecture</td> <td data-bbox="794 925 1137 958">60.0%</td> <td data-bbox="1137 925 1487 958">60.0%</td> </tr> <tr> <td data-bbox="451 958 794 992">Laboratory</td> <td data-bbox="794 958 1137 992">60.0%</td> <td data-bbox="1137 958 1487 992">20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Seminar	60.0%	20.0%	Lecture	60.0%	60.0%	Laboratory	60.0%	20.0%
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Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. D. Wilson, E. R. Adlard, M. Cooke, C. F. Poole, Encyclopedia of Separation Science, Wiley 2000.</li> <li>2. M. E. Prudich, J. Chen, T. Gu, R.B. Gupta, K.P. Johnston, H. Lutz, G. Ma, Z. Su, Perry's Chemical engineers handbook, 8<sup>th</sup> edition, The McGraw-Hill Companies, Inc. 2008</li> <li>3. <a href="https://microbenotes.com/chromatography-principle-types-and-applications/">https://microbenotes.com/chromatography-principle-types-and-applications/</a></li> <li>4. Journal: Trends in Analytical Techniques and Separation Science and Technology</li> <li>5. Mitra, S. (red.) Sample Preparation Techniques in Analytical Chemistry; John Wiley &amp; Sons Inc.:New York, 2003.</li> </ol>													
	Supplementary literature	Scientific publications on the subject matter available at Gdańsk University of Technology.													
	eResources addresses	<p>Podstawowe</p> <p><a href="https://www.academia.edu/44481513/">https://www.academia.edu/44481513/</a></p> <p>Perrys_Chemical_Engineers_Handbook - Perry's has been an important source of information related to the fundamentals and practice of chemical engineering concerning separation techniques.</p> <p>Uzupełniające</p> <p>Adresy na platformie eNauczanie:</p> <p>Separation techniques - Moodle ID: 39640</p> <p><a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=39640">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=39640</a></p>													
Example issues/ example questions/ tasks being completed	Gas separation techniques. Techniques for separation of non-volatile substances. What does retention depend on in liquid chromatography? The influence of temperature on elution in chromatography. Types of sorbents used to isolate substances from liquids. Types of filtration. Principles of green and white (analytical) chemistry. Separation of compounds based on size.														
Work placement	Not applicable														