GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	SEPARATION TECHNIQUES , PG_00064294		
Field of study	Chemical Technology		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-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	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Donata Konopacka-Łyskawa	
	Teachers	dr hab. inż. Donata Konopacka-Łyskawa	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	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	3.0	17.0	50

Subject objectives

To familiarize students with and organize information about the processes and techniques used to separate the components of single- and two-phase mixtures in the form of gases, vapors, true solutions, colloidal solutions, and suspensions. To present students with the possibility of using various methods to purify and isolate pure substances and groups of chemical compounds. To develop skills in the field of separating mixtures using selected methods.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] selects appropriate apparatus and materials for the manufacture and processing of consumer goods	selects operations and processes used to separate heterogeneous and homogeneous mixtures and characterizes methods for designing adsorption, membrane and crystallization processes	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields	performs the separation of various mixtures using selected methods and evaluates the effectiveness of the method used	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents

"Classical" separation processes. Membrane processes: classification, transport of components through the membrane, concentration polarization, balancing of membrane installations, microfiltration, ultrafiltration, nanofiltration, reverse osmosis, permeation, pervaporation. Adsorption processes: sorbents, gas-solid and liquid-solid equilibria, adsorption kinetics, desorption (PSA, TSA, inert gas). Ion exchange. Crystallization: crystallization from solution, adduct crystallization, zone crystallization. Techniques for separating mixtures using an electric field.

Prerequisites and co-requisites

Basic knowledge of physical chemistry and chemical engineering.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written test	60.0%	40.0%
Presentation	100.0%	10.0%
Laboratory	60.0%	50.0%

Recommended reading	Basic literature	1. J. D. Seader, E. J. Henley, D. K., Roper, Separation proces principles. Chemical and Biochemical Operations. 3rd Ed., J. Wiley, 2011 2. B. K. Dutta, Principles of Mass Transfer and Separation Processes, PHI Learning Private Limited, 2009
	Supplementary literature	1. R.Ven (ed), Encyclopedia of Separation Technology, vol. 1 i 2, J.Wiley, 1997 2. M. Mulder, Basic principles of membrane technology, Kluwer Academic Publishers, London 1991 3. scientific paper
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Describe the phenomenon of concentration polarization and methods of its elimination. 2. Based on appropriate diagrams (for binary and ternary systems), explain how to determine the driving force of the crystallization process. 3. Sketch a membrane installation consisting of two modules, where the retentate from the first module is directed as the feed to the second module. Label all streams. Write the mass balance for the total streams and for component A with a higher retention rate for the entire installation. Assuming that the retention coefficient for component A is R and its concentration in the feed is $C_{A,F}$, provide the theoretical concentration of component A in the permeate. 4. Based on appropriate breakthrough curves, explain how bed height affects the breakthrough time and saturation time of the bed. Explain one selected desorption method. 5. Briefly characterize the ion exchange technique. Explain the concepts of ion exchanger capacity and ion exchanger selectivity. 6. Using the appropriate graphs (for binary and ternary systems), explain how to determine the driving force for the crystallization process.	
Work placement	Not applicable	

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