



Subject card

Subject name and code	Separation Techniques, PG_00064294						
Field of study	Chemical Technology						
Date of commencement of studies	February 2027		Academic year of realisation of subject		2027/2028		
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Donata Konopacka-Łyskawa				
	Teachers						
Lesson types	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_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields		is able to perform the separation of various mixtures using selected methods and evaluates the effectiveness of the method used		[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		
	[K7_W02] selects appropriate apparatus and materials for the manufacture and processing of consumer goods		has knowledge to select operations and processes used to separate heterogeneous and homogeneous mixtures and characterizes methods for designing adsorption, membrane and crystallization processes		[SW1] Assessment of factual knowledge		
Subject contents	Course content – lecture						
	Classification of 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.						
	Course content – laboratory						
	Separation of salt solution using reverse osmosis. Leaching of colored substances from plant material, separation of dyes using chromatographic methods. Separation of gas mixtures using adsorption. Water desalination using ion exchange.						
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
	Lecture - written test	60.0%	40.0%
	Laboratory - performing laboratory exercises,reports	60.0%	50.0%
	Lecture - lecture activites	60.0%	10.0%
Recommended reading	Basic literature	<div>1. J. D. Seader, E. J. Henley, D. K., Roper, Separation proces principles. Chemical and Biochemical Operations. 3rd Ed., J. Wiley, 2011 / 4th Ed. Wiley 2019</div> <div>2. B. K. Dutta, Principles of Mass Transfer and Separation Processes, PHI Learning Private Limited, 2009</div>	
	Supplementary literature	<div>1. R.Ven (ed), Encyclopedia of Separation Technology, vol. 1 i 2, J.Wiley, 1997</div> <div>2. M. Mulder, Basic principles of membrane technology, Kluwer Academic Publishers, London 1991</div> <div>3. scientific paper</div>	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<div>1. Describe the phenomenon of concentration polarization and methods of its elimination.</div> <div>2. Based on appropriate diagrams (for binary and ternary systems), explain how to determine the driving force of the crystallization process.</div> <div>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.</div> <div>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.</div> <div>5. Briefly characterize the ion exchange technique. Explain the concepts of ion exchanger capacity and ion exchanger selectivity.</div> <div>6. Using the appropriate graphs (for binary and ternary systems), explain how to determine the driving force for the crystallization process.</div>		
Practical activites within the subject	Not applicable		

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