



## Subject card

Subject name and code	Membrane processes, PG_00049379						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2024	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	4	Language of instruction			Polish		
Semester of study	7	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Radosław Pomećko				
	Teachers						
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		42.0	75
Subject objectives	The aim of the course is to acquaint students with the new operational processes and using membranes. Clarify the concept of membranes and their classification, division into natural and synthetic. Elucidation of the mechanisms of separation and presentation of the process determinants such as differential pressure, concentration, etc.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	The student can analyze given problems and data, to find the right the solution.			[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[K6_U51] can conduct laboratory work connected with chemistry and biochemistry, specific to biomedical engineering	The student has the knowledge and abilities to solve given problems.			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
Subject contents	Membrane processes, development and history; basic concepts, the membrane (definition), biological membranes; classification of the membranes and methods of their preparation; Membrane modules; The parameters characterizing the processes: the driving force, mass flow, the ability separation membranes, selectivity and efficiency of the process; Pressure membrane processes (nano-, ultra- and microfiltration, reverse osmosis); The processes of the driving force c: dialysis and hemodialysis, gas separation, pervaporation; Liquid membranes (BLM, SLM PIM), transport of ions and non-electrolytes; Media ion transport through the membrane: structure and properties of the compounds ionophore (conveyors). Current separation techniques - electro dialysis; membrane reactors. Examples of medical applications of membrane processes.						
Prerequisites and co-requisites	Basics of organic chemistry, inorganic chemistry, physical chemistry and principles of polymers. Knowledge on equilibrium in particular Donnan equilibrium, chemical potentials and selectivity						
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Practical exercises	51.0%			30.0%		
	Written exam	51.0%			70.0%		

Recommended reading	Basic literature	<p>1. R. Rautenbach: Procesy membranowe, WNT, Warszawa, 1996.</p> <p>2. Praca zbiorowa, Red. R. Wódzki: Membrany teoria i praktyka UMK, Toruń, 2003</p> <p>3. E. Biernacka, T. Suchecka: Techniki membranowe w ochronie środowiska, Wyd. SGGW, W-wa 2004</p> <p>4. K. Konieczny, M. Bodzek: Usuwanie zanieczyszczeń nieorganicznych ze środowiska wodnego metodami membranowymi, SEIDEL-PRZYWECKI, 2011</p> <p>5. A.Figoli , A.Criscuoli (eds.): Sustainable Membrane Technology for Water and Wastewater Treatment, Springer Nature Singapore Pte Ltd. 2017</p>
	Supplementary literature	<p>1. R. Praca zbiorowa: Membrany i membranowe techniki rozdziału, pod red. A. Narebskiej UMK, Toruń 1997.</p> <p>2. N.Li, A.G. Fane, T. Matsuura: Advanced Membrane Technology and Applications, J. Wiley &amp; Sons, Ltd, 2008.</p> <p>3. M. Mulder: Basic Principle of Membrane Technology, Kluwer, The Netherlands, 1991</p>
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<p>1. Definitions: membrane, the feed, permeate, retentate, Donnan equilibrium,</p> <p>2. Mechanisms of membrane processes</p> <p>3. Reverse Osmosis</p> <p>4. Hemodialysis</p> <p>5. The use of membrane processes in medicine</p>	
Work placement	Not applicable	

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