



## Subject card

Subject name and code	Advanced Heat and Mass Transfer Operations and Processes, PG_00048863						
Field of study	Engineering and Technologies of Energy Carriers						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
Education level	second-cycle studies	Subject group			Obligatory subject group in the field of study Subject group related to practical vocational preparation		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			6.0		
Learning profile	practical profile	Assessment form			assessment		
Conducting unit	Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Donata Konopacka-Łyskawa					
	Teachers	dr hab. inż. Donata Konopacka-Łyskawa dr inż. Iwona Hołowacz					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	30.0	0.0	90
	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	90		10.0		50.0	150
Subject objectives	To familiarize students with the selected advanced heat transfer and mass transfer processes: drying with using of superheated steam, absorption, adsorption processes, membrane processes, crystallization processes and processes with using of supercritical fluids. Presenting students the opportunities to use mathematical equations in the description of the presenting processes. Deloping students' computing skills for the selected processes.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K7_U09	The student is able to work in a team that performs a project task, including a team project manager.	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
	K7_U04	The student indicates the advantages and disadvantages of the discussed advanced processes of heat and mass transfer. Student is able to apply a mathematical description to design selected heat and mass transfer processes.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
	K7_W04	The student knows and understands the designing methodology of selected advanced processes of heat and mass transfer.	[SW1] Assessment of factual knowledge
	K7_W06	The student knows and understands the theoretical backgrounds of selected advanced processes of heat and mass transfer.	[SW1] Assessment of factual knowledge
	K7_U03	Student to solve project tasks uses knowledge of fluid flow, material and heat balances, criterion equation and physicochemical equilibria.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
Subject contents	Drying with superheated steam: thermodynamics of superheated steam, equilibrium and kinetics of drying of porous materials. Absorption and desorption: absorption equilibria, counter-current absorption of single component, multicomponent counter-current absorption, desorption, absorption with chemical reaction. Adsorption processes: sorption isotherms, adsorption and desorption kinetics, pressure swing processes and temperature swing processes. Membrane processes: membrane types and structure, gas permeation, gas diffusion, pervaporation, microfiltration, ultrafiltration, reverse osmosis, dialysis and electrodialysis. Crystallization methods: zone refining and additive crystallization. Processes using supercritical fluids: supercritical extraction and crystallization using supercritical fluids.		
Prerequisites and co-requisites	Properties of liquids and gases. Basic knowledge of physical chemistry: equilibria and diffusion.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Test	60.0%	4.0%
	Test	60.0%	36.0%
	Labs	60.0%	20.0%
	Mini-projects and project	60.0%	16.0%
	Lecture tests	60.0%	24.0%
Recommended reading	Basic literature	D. W. Green, R. H. Perry: Perry's Chemical Engineers' Handbook, 8th ed.	
	Supplementary literature	scientific papers	
	eResources addresses	Adresy na platformie eNauczenie: Zaawansowane operacje i procesy wymiany ciepła i masy - laboratorium 2023/24 - Moodle ID: 34207 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34207">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34207</a> Zaawansowane operacje i procesy wymiany ciepła i masy - laboratorium 2023/24 - Moodle ID: 34207 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34207">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34207</a> Zaawansowane operacje i procesy wymiany ciepła i masy - laboratorium 2023/24 - Moodle ID: 34207 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34207">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34207</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		