



Subject card

Subject name and code	Chemical engineering, PG_00060865						
Field of study	Chemical Technology						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2025/2026		
Education level	first-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	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Iwona Hołowacz				
	Teachers		dr inż. Karolina Kucharska dr inż. Iwona Hołowacz dr inż. Edyta Słupek				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	30.0	0.0	60
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 29896 TCH Inżynieria chemiczna Laboratorium 2025/26 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29896 Moodle ID: 29896 TCH Inżynieria chemiczna Laboratorium 2025/26 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29896 Moodle ID: 29896 TCH Inżynieria chemiczna Laboratorium 2025/26 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29896						
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	60		10.0		80.0	150
Subject objectives	To familiarize students with the basic concepts of dynamic operations (fluid flows, mixing, filtration, settling of particles, fluidization) and the heat exchange processes (conduction, convection, radiation). Presenting students with opportunities to use mathematical equations in the description of the unit operations used in chemical engineering Developing students computing skills for the relevant unit operations.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U04] performs basic design calculations of selected processes and unit operations, is able to calculate and select the basic apparatus of chemical industry in a process line	The student is prepared to use mathematical and physicochemical knowledge to calculate and analyze the course of basic unit operations in chemical engineering. The student knows how to make measurements of fluid motion parameters during dynamic, thermal and diffusion processes. The student can: - determine fluid movement parameters and design a typical hydraulic system for the chemical industry on the basis of mass and energy balance - apply theories of solids motion in fluids for basic calculations in filtration processes, gas dedusting, suspension sedimentation and liquid mixing - determine heat fluxes for established conduction, penetration and thermal radiation processes - perform thermal calculations for heat exchangers	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[K6_W04] understands processes occurring in the life cycle of equipment and facilities and has knowledge of mechanical engineering, chemical apparatus, technical thermodynamics and chemical engineering and chemical reactor engineering necessary to analyse technological processes and correctly design installations and systems in the chemical industry	The student knows: - basics of the theory of dimensional analysis, basic criterion numbers, their physical meaning and meaning in engineering sciences - principles of perfect and real fluid flow in pipes and through a porous beds - theory of solids motion in liquids - theory of heat transfer in solids, between fluid and solid, between diaphragm separated fluids and as a result of thermal radiation - the basis for designing of typical chemical apparatus	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K6_U12] applies the principles of health and safety at work	The student understands and complies with the health and safety regulations in force at laboratory workstations. The student maintains order and the proper use of equipment, and wears appropriate protective clothing.	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment
	[K6_K02] understands the non-technical aspects and implications of the activities of a chemical engineer, including the impact on the environment, is aware of professional behaviour, observance of professional ethics and respect for diversity of views and cultures	The student is aware of the impact of chemical industry processes on the surroundings and the environment.	[SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills
Subject contents	The flow of fluids. Fluid properties. The continuity of the stream. Bernoulli's equation. Flow of real fluids. Laminar flow and turbulent flow. Distribution of flow velocity. Measurement of flow rate. Flow resistance of the tubes and through a packed bed. Rheological properties of fluids. Fluidization. Critical velocity of fluidization. The flow of two-phase gas - liquid. Filtration. The motion of particles through fluids. Mixing. Power and efficiency of mixing. Heat transfer. Heat conduction. Heat transfer during forced convection and free convection. Heat transfer during boiling and condensation. Radiation. Overall heat transfer. Heat exchangers. Concentrating the solutions by evaporation. The mass exchange. The basic law of diffusion. Mass transfer coefficients and overall mass transfer coefficients.		
Prerequisites and co-requisites	Properties of liquids and gases. Basic knowledge of physical chemistry. Differential and integral calculus. Knowledge of the structure and operation of typical instruments and equipment used in the chemical and related industries.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests and reports	60.0%	25.0%
	tests and design task	60.0%	25.0%
	written exam	60.0%	50.0%

Recommended reading	Basic literature	<p>M. Serwiński: Zasady inżynierii chemicznej. WNT 1982.</p> <p>A. Selecki, L. Gradoń: Podstawowe procesy przemysłu chemicznego. WNT 1985.</p> <p>P. Lewicki: Inżynieria procesowa i aparatura przemysłu spożywczego. WNT 2005</p> <p>R. Zarzycki: Wymiana ciepła i ruch masy w inżynierii środowiska. WNT 2010</p> <p>D. Konopacka-Lyskawa (red.): Inżynieria chemiczna i procesowa wybrane zagadnienia, Wydawnictwo PG, Gdańsk, 2022.</p> <p>D. Konopacka-Lyskawa (red.): Podstawy inżynierii chemicznej i procesowej, Wydawnictwo PG 2012</p> <p>I. Hołowacz (red.): Przykłady i zadania z podstaw inżynierii chemicznej i procesowej, Wydawnictwo PG 2017</p> <p>D. W. Green (ed.): Perry's Chemical Engineers' Handbook, The McGraw-Hill Comp. Inc. (8th ed.) 2008.</p>
	Supplementary literature	<p>Z. Orzechowski, J. Prywer, R. Zarzycki: Mechanika płynów w inżynierii i ochronie środowiska. WNT 2009.</p> <p>Z. Orzechowski: Przepływy dwufazowe. PWN 1990.</p> <p>R. Koch, A. Noworyta: Procesy mechaniczne w inżynierii chemicznej. WNT 1992.</p> <p>T. Hobler: Ruch ciepła i wymienniki. WNT 1986.</p> <p>R. Zarzycki: Zadania rachunkowe w inżynierii chemicznej, PWN 1980.</p> <p>K. Pawłow i in.: Przykłady i zadania z zakresu aparatury i inżynierii chemicznej, WNT 1981</p> <p>W.L. McCabe, J.C.Smith: Unit operations of chemical engineering, The McGraw-Hill Comp. Inc. (7th ed.) 2005.</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>1. Water at temperature t flows from an open tank with a large cross-section through the pipe with a pressure P at its outlet. What should be the height of the liquid level in the tank above the level of the discharge outlet from the pipe so that the volume flow rate of liquid from the conduit is V. Two 90° elbows and a valve are mounted on the pipe. Data: diameter and length of all pipe sections. Determine the fluid pressure at the inlet to the pipe.</p> <p>2. Draw the course of the relationship of the pressure drop of the fluid as a function of the linear velocity of the fluid flowing through the porous layer, if the fluid reaches the bottom of the packed column. Mark the minimum and maximum fluidization speed and explain their meaning. Characterize the bed state for u_{max}. How the fluidization curve will change and why if: we reduce the bed height; we will increase the density of the solid; we will reduce the particle size of the solid. The comparison should be made on a common graph.</p> <p>3. A shell-and-tube heat exchanger of known dimensions is heated by a stream of heating steam at the pressure p, flowing into the inter-tube space. A water solution with a temperature ranging from t_r flows to the exchanger tubes. Specify how, on the basis of the above-mentioned data, to calculate the heat exchange surface in the exchanger and the driving force of the heat exchange. Report the assumptions made.</p> <p>4. Draw a diagram of a countercurrent condenser in which a differential condensation process is carried out. Mark the streams and their compositions. Record the material balance of the lower boiling component at any point in the process. Present the course of this process on a physicochemical equilibrium graph in the system $t=f(x, y)$ and $y=f(x)$.</p>	
Work placement	Not applicable	

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