GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	CHEMICAL REACTORS ENGINEERING, PG_00064292		
Field of study	Chemical Technology		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	blended-learning
Year of study	1	Language of instruction	Polish
Semester of study	1	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. Jacek Gębicki	
	Teachers	dr hab. inż. Jacek Gębicki dr inż. Anna Grzegórska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30

E-learning hours included: 15.0

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Moodle ID: 4951 INŻYNIERIA REAKTORÓW CHEMICZNYCH TCh https://enauczanie.pg.edu.pl/2025/course/view.php?id=4951

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 introduce students to concepts related to the design of various types of chemical reactors. To familiarize students with design equations and mass and heat balances for individual reactors. To describe real reactors. To map the actual residence time distribution in reactors. To develop students' computational and design skills.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U03] designs innovative technological solutions for obtaining useful goods based on the state of the knowledge in accordance with the latest scientific literature	The student is able to perform calculations and designs using knowledge of design equations and heat transfer equations for various types of reactors.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W04] recognises scientific, technological, organisational and economic opportunities and constraints in technology and related fields	The student knows and is able to analyze the technical, technological and economic limitations encountered when designing various types of reactors.	[SW3] Assessment of knowledge contained in written work and projects
[K7_K01] critically evaluates the content of cognitive and practical problems	The student is able to critically evaluate the problems associated with the selection of a chemical reactor for a given chemical reaction.	[SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice

Subject contents	Course content – lecture 1. Chemical reaction rates, determining the kinetic equation. 2. The relationship between reaction rates and the degree of conversion. 3. Ideal reactors 4. Mass and heat balance 5. Isothermal, adiabatic, and non-isothermal processes 6. Design equations for selected reactors 7. Residence time distribution functions for ideal and real reactors. 8. Calculation methods for real reactors 9. Surface processes in contact reactions. Effects of temperature and pressure. Course content – exercises 1. Mass and mole fractions. Conversion rate. Conversion and stoichiometry of chemical reactions. 2. Kinetics of chemical reactions (reaction order, reaction rate constant). Dependence of reaction rate on temperature (Aarhenius equation). 3. Reversible reactions - chemical reaction equilibrium. 4. Parallel and series reactions. 5. Types of chemical reactors. Perfectly stirred batch reactor. 6. Plug flow reactor. 7. Comparison and selection of batch and plug flow reactors. 8. Reactor cascade. 9. Packed bed reactor.
Prerequisites and co-requisites	Knowledge of physical, organic, and inorganic chemistry. Knowledge of chemical engineering and chemical technology.
Assessment methods and criteria	(see table below)

Subject passing criteria	Passing threshold	Percentage of the final grade
theoretical knowledge test - 2 tests	60.0%	60.0%
2 tests on computational tasks	60.0%	40.0%

Recommended reading	Basic literature	C.G. Hill, T.W.Root: Introduction to chemical engineering kinetics & reactors design 2nd ed., JohnWiley & Sons, Inc. 2014. G.F. Froment, K.B. Bischoff, J. de Wilde: Chemical reactor analysis and design, JohnWiley & Sons, Inc. 2011. U. Mann, Pronciples of chemical reactor analysis and design, New tools for industrial chemical reactor operations 2nd ed., JohnWiley & Sons, Inc. 2009. W.L. Luyben, Chemical ractor design and control, JohnWiley & Sons, Inc. 2007. A. Burghardt, Bartelmus G., Inżynieria reaktorów chemicznych, PWN 2001. J. Szarawara, J. Piotrowski: Podstawy teoretyczne technologii chemicznej, WNT 2010.
	Supplementary literature	PG library resources on reactor engineering, design and calculation
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. The conversion rate as a function of time in an ideal tubular reactor is: a) constant b) decreasing c) increasing d) undeterminable 2. In flow reactors, increasing the volumetric flow rate causes the conversion rate to: a) increase b) decrease c) be constant d) depend on the initial concentration 3. As the Pe number decreases, the flow of reactants approaches the conditions of: a) plug flow b) laminar flow c) perfectly mixed flow d) none of these	
Practical activites within the subject	Not applicable	

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