



Subject card

Subject name and code	Basics of chemical reactor engineering, PG_00069030						
Field of study	Chemical Technology						
Date of commencement of studies	October 2025	Academic year of realisation of subject			2027/2028		
Education level	first-cycle studies	Subject group			Obligatory subject group 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	6	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jacek Gębicki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	30.0	0.0	0.0	0.0	45
	E-learning hours included: 0.0						
eNauczenie source address: https://enauczenie.pg.edu.pl/2025/user/index.php?id=4947							
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	45		5.0		25.0	75
Subject objectives	To introduce students to concepts related to the technological classification of reactors, particularly the description of ideal reactors. To familiarize students with the relationships used to calculate reactant residence times and the degree of reactant conversion in reactors operating under isothermal and adiabatic conditions. To familiarize students with the design equations and heat balance in ideal reactors. To develop students' skills in basic calculations related to reactor theory.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W04] Possesses the technical knowledge necessary to analyze processes and design installations in the chemical industry.		has knowledge of the theory of chemical reactors and knows the operating principle of basic types of reactors in the chemical industry.		[SW3] Assessment of knowledge contained in written work and projects		
	[K6_U08] Is able to select elements of automatic control systems for simple technological processes and use computer programs to control and optimize chemical processes.		can select process control elements for simple processes and unit operations. Furthermore, they are familiar with and use programs that simulate chemical processes.		[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools		
	[K6_K01] Is aware of the social role of a technical university graduate and understands the need to provide information about technical achievements and engineering activities to society, including through the media.		is able to communicate advancements in science and technology using modern communication methods, in a manner tailored to the audience.		[SK2] Assessment of progress of work [SK4] Assessment of communication skills, including language correctness		

Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. Technological classification of reactors. Batch reactor. Perfectly mixed flow reactor. Plug flow reactor. 2. Isothermal and adiabatic processes. 3. Cascade of perfectly mixed flow reactors. Comparison of a perfectly mixed reactor cascade with a plug flow reactor. 4. Design of isothermal, perfectly mixed, or plug flow reactors. 5. The influence of conversion kinetics on the selection of reactor type for single reactions. 		
	<p>Course content – exercises</p> <ol style="list-style-type: none"> 1. Mole and mass fractions. Determining the degree of reaction conversion. Conversion and the stoichiometry of chemical reactions. 2. Kinetics of chemical reactions (reaction order, reaction rate constant). Dependence of reaction rate on temperature (Aarhenius equation). 3. Design equation for a batch reactor. Determining residence time and reactor volume. 4. Thermal effects of reactions, heat balance of a batch reactor. 5. Design of a batch reactor (kinetics, reaction order, residence time, reactor volume). 6. Design of a batch reactor (characterization of the reaction environment, material selection, heat). 7. Design of a batch reactor (selection of stirrer power and dimensions). 		
Prerequisites and co-requisites	Knowledge of unit operations and processes, the structure and functioning of basic industrial plant components. Principles of conservation of mass, energy, and momentum. Mass and thermal process balancing.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exercises - test	60.0%	20.0%
	exercises - project implementation	100.0%	20.0%
	lecture - 2 tests	60.0%	60.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. A. Burghardt, Bartelmus G., Inżynieria reaktorów chemicznych, PWN 2001. 2. J. Szarawara, J. Piotrowski: Podstawy teoretyczne technologii chemicznej, WNT 2010. 3. S. Kucharski, J. Głowiński: Podstawy obliczeń projektowych w technologii chemicznej, Oficyna Wydawnicza Politechniki Wrocławskiej, 2005 	
	Supplementary literature	<ol style="list-style-type: none"> 1. B. Tabiś, W. Żukowski: Przykłady i zadania z zakresu inżynierii reaktorów chemicznych, Politechnika Krakowska 2000 2. K. Schmidt-Szałowski i in.: Technologia Chemiczna, PWN 2013 	
	eResources addresses		

Example issues/ example questions/ tasks being completed	<p>Task 1. In a tank with a usable volume of 0.5 m³ and a stirred tank, the reaction A+B=C is carried out. The initial concentration of component A is 0.05 kmol/m³ and the concentration of component B is twice as high. The rate constant is 0.09 m³/(kmol*h). Determine the conversion rate of A.</p> <p>Task 2. The conversion rate A=2P is described by a first-order kinetic equation (k=2.5 h). Determine the average residence time of the reaction mixture in a cascade of four identical, perfectly mixed reactors if a conversion rate of a=0.9 is required. What residence time would be necessary to achieve this conversion rate in a single stirred reactor?</p>
Practical activities within the subject	Not applicable

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