

Subject card

Subject name and code	Design and build a small chemical device, PG_00179592						
Field of study	Chemical Business, Chemistry						
Date of commencement of studies	February 2026		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Optional subject group		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		1.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Laboratory of Photocatalysis -> Department of Environmental Technology -> Faculty of Chemistry -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Mazierski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	15.0	0.0	0.0	15
	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	15		5.0		10.0	30
Subject objectives	The aim of the course is to develop the ability to design and construct simple chemical devices used in laboratories and in the chemical industry. Working in teams, students will go through the entire process of creating a selected device from the analysis of available technologies, through conceptual design, to the construction of a prototype using, among other things, 3D printing, workshop tools, and basic electronic components. Example projects include: • pH meter a pH sensor based on Arduino, with a display and calibration • Laboratory centrifuge a low-budget device for component separation • Automatic magnetic stirrer controlled by a microcontroller • Spectrophotometer a device for basic optical analyses						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BCHMU2_K04] Is willing to properly assess the acquired knowledge, respect and disseminate it in order to solve specific cognitive and practical issues.	- critically evaluates the knowledge acquired while designing and constructing a chemical device, - respects the principles of reliability and accuracy when preparing documentation and during laboratory work, - shares acquired knowledge and experience with team members during project implementation, - uses and transfers acquired knowledge to solve practical engineering problems during prototype testing and optimization.	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report [SK8] observation of student's independent or team work
	[BCHMU2_U05] Is able to choose and apply, based on the literature of chemical sciences in Polish and English, appropriate methods and tools for solving problems in chemistry and related sciences.	- searches for and uses scientific literature in Polish and English to analyze methods for designing chemical devices, - is able to select and apply appropriate measurement methods and engineering tools (3D printing, microcontrollers, sensors) for implementing the device project, - uses information from literature to solve design and functional problems during the construction and testing of the device, - is able to prepare technical documentation of the prototype based on literature data and engineering standards.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
	[BCHMU2_W04] Knows and understands specialist IT tools used in chemical diagnostics.	- knows and understands the use of specialized IT tools applied in designing chemical devices (CAD software, simulations, data processing programs), - knows and understands the use of software for operating sensors and microcontrollers used in chemical diagnostics, - is able to use IT tools to prepare technical documentation and analyze data obtained during prototype testing, - understands the importance of selecting appropriate IT tools to increase the accuracy and efficiency of chemical diagnostics.	[SW1] oral statement/conversation/discussion [SW2] presentation/project/paper/report
	[BCHMU2_U04] Is able to independently plan and perform specific research tasks in the field or in the laboratory, interpret their results working individually or in a team, assuming various roles and functions including managerial.	- independently plans the stages of a project involving the construction of a simple chemical device, - performs tasks related to designing, assembling, and testing the device prototype under laboratory conditions, - interprets the results of device tests and calibration, indicating necessary modifications, - is able to work individually and effectively in a team, taking on various roles, including that of a project team coordinator.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU5] implementation of a problem task [SU8] observation of student's independent or team work
	[BCHMU2_K01] Is willing to develop and disseminate appropriate best practices at and outside the workplace.	- applies occupational safety and hygiene rules while designing and constructing a chemical device, - uses good engineering and documentation practices during project implementation, - shares knowledge and supports team members while working on the project, - promotes the principles of professional responsibility and integrity while performing project and laboratory tasks.	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report [SK8] observation of student's independent or team work

Subject contents	The course covers both theoretical and practical aspects, allowing students to go through the entire process of creating a chemical device. In the seminar part, students will become familiar with the fundamentals of designing chemical devices, the analysis of available technologies, the principles of operation of sensors and electronic systems, and the use of 3D printing in chemical engineering. Issues related to project documentation and prototype optimization will also be discussed. In the laboratory part, students will have the opportunity to independently design, print, assemble, and test their devices. Practical exercises will include working with a 3D printer, assembling mechanical and electronic components, calibrating, and testing the functionality of the prototype, enabling students to acquire valuable interdisciplinary skills.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Prototype	51.0%	40.0%
	Report	51.0%	30.0%
	Project	51.0%	30.0%
Recommended reading	Basic literature	- Kamrani, Ali K.; Nasr, Emad Abouel - Rapid Prototyping theory and practice	
	Supplementary literature	- Bhowmik, Sumit - Modeling and Optimization of Advanced Manufacturing Processes	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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