University of Gdańsk

Subject card

Subject name and code	Design and build a small chemical device, PG_00179589						
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	15.0	0.0	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 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: • **pH meter** a pH sensor based on Arduino, with display and calibration • **Laboratory centrifuge** a low-budget device for component separation • **Automatic magnetic stirrer** controlled by a microcontroller • **Spectrophotometer** a device for simple optical analyses						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BCHMU2_W01] Knows and understands complex physicochemical processes and is able to analyse their course in connection with other fields of science.	- knows and understands the physicochemical processes occurring in the designed device (e.g., mixing, separation, measurement of chemical parameters), - is able to relate these processes to knowledge from electronics, materials engineering, and occupational safety, - analyzes the impact of process parameters (e.g., temperature, pH, reaction time) on the device's operation, - understands the importance of optimizing process conditions during the design and testing of the device.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[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 possessed in the field of designing and constructing chemical devices, - respects the principles of reliability and accuracy when preparing project documentation, - shares knowledge and experience during teamwork on the project, - uses and transfers acquired knowledge to solve practical engineering problems while designing and testing the device.	[SK2] presentation/project/paper/ report [SK6] demonstration of practical skills [SK8] observation of student's independent or team work
[BCHMU2_W02] Knows and understands the axiological conditions regarding the use of modern measuring techniques and instruments as well as IT tools in chemistry, including economic aspects.	- knows and understands the principles of selecting modern measurement techniques (e.g., sensors, measurement modules) when designing chemical devices, - understands the importance of using IT tools (software for 3D design, simulations, microcontroller control) in the process of designing and optimizing the device, - takes into account economic aspects when selecting measurement technologies and IT tools, - knows the principles of responsible and ethical use of modern technologies in engineering projects.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[BCHMU2_U01] Is able to, on the basis of her/his knowledge, propose a solution to problems in chemistry, taking into account the economic aspect by using advanced measurement techniques.	- is able to conceptually design a simple chemical device to solve a selected analytical or technological problem, - is able to select economically justified materials and components for the device, - uses basic measurement techniques to calibrate and test the prototype, - is able to apply engineering knowledge to optimize the device’s operation.	[SU5] implementation of a problem task [SU6] demonstration of practical skills
[BCHMU2_K01] Is willing to develop and disseminate appropriate best practices at and outside the workplace.	- applies safety and ergonomic rules while working with tools and devices, - uses good documentation practices in designing and building the device, - collaborates in a team by sharing knowledge and experience, - is ready to promote adopted good design and technological practices in team and individual work.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report

<table>
<tr><td>Subject contents</td><td>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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Prototype</td><td>51.0%</td><td>40.0%</td></tr>
<tr><td>Report</td><td>51.0%</td><td>30.0%</td></tr>
<tr><td>Project</td><td>51.0%</td><td>30.0%</td></tr>
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</td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>- Kamrani, Ali K.; Nasr, Emad Abouel - Rapid Prototyping theory and practice</td></tr>
<tr><td>Supplementary literature</td><td>- Bhowmik, Sumit - Modeling and Optimization of Advanced Manufacturing Processes</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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