University of Gdańsk

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 2027	Academic year of realisation of subject	2027/2028
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_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
[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_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_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

<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>Project</td><td>51.0%</td><td>30.0%</td></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>
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<tr><td>Recommended reading</td><td>
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<tr><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>
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<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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