University of Gdańsk

Subject card

Subject name and code	Microcontroller-based chemical diagnostics, PG_00033144						
Field of study	Chemical Business, Chemistry						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2025/2026			
Education level	Bachelor'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 ENG			
Semester of study	4		ECTS credits	2.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Cezary Czaplewski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	0.0	0.0	30
	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	30		5.0	15.0	50	
Subject objectives	Familiarize students with the basics of chemical diagnostics based on electronic circuits.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEML3_W08] Demonstrates knowledge of basic computational methods to solve problems in chemistry, physics, mathematics.	The student names and describes types and data structures based on the C language and the Arduino environment.	[SW2] presentation/project/paper/ report
[CHEML3_W07] Understands and describes physicochemical patterns, phenomena and processes using the language of mathematics.	The student names and describes types and data structures based on the C language and the Arduino environment. The student distinguishes between the control instructions of the C language and the Arduino environment.	[SW2] presentation/project/paper/ report
[CHEML3_U06] Uses basic application software packages to solve problems from the field of science.	The student designs simple algorithms, writes them using the C language and the Arduino environment and then compiles and tests the resulting programs.	[SU8] observation of student's independent or team work
[CHEML3_U02] Performs analyses using experimental methods and draws conclusions based on them.	The student builds simple electronic circuits using the Arduino microcontroller. The student uses built and programmed electronic systems to conduct experiments.	[SU8] observation of student's independent or team work
[CHEML3_K08] Formulates opinions in the field of science with caution and criticism in their expression.	The student develops the ability to make precise and logical inferences. The student learns the principles of safe, responsible and effective work with digital devices (microcontrollers). The student develops the ability to work in a team.	[SK8] observation of student's independent or team work
[CHEML3_W09] Describes the practical applications of IT tools (computer programmes) for chemical calculations and data analysis.	The student distinguishes between the control instructions of the C language and the Arduino environment.	[SW2] presentation/project/paper/ report

Subject contents

Building, programming and testing of electronic circuits used in chemical diagnostics, min:
- Fundamentals of microcontroller programming in Arduino environment with selected examples (variables and operators, conditional instruction, loop instructions, functions).
- Arduino communication with the computer using the C compiler.
- Operation of analog and digital sensors.
- Construction and calibration of a breathalyzer using an Arduino microcontroller and an analog sensor that changes resistance depending on the concentration of ethanol vapors.
- Electrochemical sensors: detection of methane and other flammable gases, detection of carbon monoxide.
- Construction and calibration of colorimeter based on Arduino microcontroller, rgb diode and color sensor. Color recognition, colorimeter calibration according to Lambert-Beer's law for different dilutions of the selected dye

Other sensors: detection of methane and other flammable gases, detection of carbon monoxide.-.
Construction and calibration of colorimeter based on Arduino microcontroller, rgb diode and color sensor. Color recognition, colorimeter calibration according to Lambert-Beer's law for different dilutions of the selected dye

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Reports on the execution of exercises	51.0%	100.0%

Recommended reading

Basic literature	Programming Arduino: Getting Started with Sketches, Simon Monk, McGraw-Hill Education Ltd 2022
Supplementary literature	Programming Arduino Next Steps: Going Further with Sketches, Simon Monk, McGraw-Hill Education Ltd 2018
eResources addresses	

Example issues/ example questions/ tasks being completed

Construction of series and parallel circuits.

A circuit using a potentiometer.

Construction of a measuring circuit that tests for the presence of selected gases.

Programming the LCD display.

Work placement

Not applicable

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