

Subject card

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|--|--|--|---------------------------------|-------------------------------------|---------|------------------------|-----|
| Subject name and code | Microcontroller-based chemical diagnostics, PG_00103591 | | | | | | |
| Field of study | Environmental Protection | | | | | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | | | | 2026/2027 | |
| 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 | 3 | Language of instruction | | | | Polish ENG | |
| Semester of study | 6 | 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. | | | | | | |

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| Learning outcomes | Course outcome | Subject outcome | Method of verification |
| | [OŚL3_U02] Plans, selects appropriate research and measuring equipment and devices, performs physicochemical measurements and experiments; analyses the results and draws conclusions based on them. | The student builds simple electronic circuits using the Arduino microcontroller. The student designs simple algorithms, writes them using the C language and the Arduino environment and then compiles and tests the resulting programs. | [SU2] presentation/project/paper/report [SU5] implementation of a problem task [SU8] observation of student's independent or team work |
| | [OŚL3_U08] Correctly concludes based on the available data from various sources. | The student uses independently built and programmed electronic circuits to perform experiments. | [SU2] presentation/project/paper/report [SU5] implementation of a problem task [SU8] observation of student's independent or team work |
| | [OŚL3_K02] Works individually demonstrating initiative and independence in actions, and effectively cooperates in a team, performing various roles in it. | 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. | [SK5] implementation of a problem task [SK8] observation of student's independent or team work |
| | [OŚL3_W09] Describes the basic methods, techniques and tools that allow the rational use, shaping and restoration of natural resources. | The student knows how to design an electronic measurement system. | [SW2] presentation/project/paper/report |
| [OŚL3_W03] Operates mathematical, statistical and IT methods and tools in the description and interpretation of phenomena and processes occurring in the environment. | 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 | |
| Subject contents | Building, programming and testing of electronic circuits used in chemical diagnostics: - 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 | | |
| 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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