

## Subject card

|                                             |                                                                                                                                    |                                                          |                                         |                                     |                                                                                                                                                |            |     |
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| Subject name and code                       | Diploma Laboratory, PG_00188355                                                                                                    |                                                          |                                         |                                     |                                                                                                                                                |            |     |
| Field of study                              | Pracownia dyplomowa (Ćw.laboratoryjne)                                                                                             |                                                          |                                         |                                     |                                                                                                                                                |            |     |
| Date of commencement of studies             | October 2026                                                                                                                       |                                                          | Academic year of realisation of subject |                                     | 2028/2029                                                                                                                                      |            |     |
| Education level                             | Bachelor's studies                                                                                                                 |                                                          | Subject group                           |                                     | Obligatory subject group in the field of study<br>Optional subject group<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | full-time studies                                                                                                                  |                                                          | Mode of delivery                        |                                     | at the university                                                                                                                              |            |     |
| Year of study                               | 3                                                                                                                                  |                                                          | Language of instruction                 |                                     | Polish                                                                                                                                         |            |     |
| Semester of study                           | 6                                                                                                                                  |                                                          | ECTS credits                            |                                     | 4.0                                                                                                                                            |            |     |
| Learning profile                            | academic                                                                                                                           |                                                          | Assessment form                         |                                     | credit                                                                                                                                         |            |     |
| Conducting unit                             | Faculty of Chemistry -> Rector                                                                                                     |                                                          |                                         |                                     |                                                                                                                                                |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                 |                                                          | dr hab. Joanna Makowska                 |                                     |                                                                                                                                                |            |     |
|                                             | Teachers                                                                                                                           |                                                          |                                         |                                     |                                                                                                                                                |            |     |
| Lesson types                                | Lesson type                                                                                                                        | Lecture                                                  | Tutorial                                | Laboratory                          | Project                                                                                                                                        | Seminar    | SUM |
|                                             | Number of study hours                                                                                                              | 0.0                                                      | 0.0                                     | 60.0                                | 0.0                                                                                                                                            | 0.0        | 60  |
|                                             | 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                                                                                                              | 60                                                       |                                         | 10.0                                |                                                                                                                                                | 30.0       | 100 |
| Subject objectives                          | Acquiring the ability to correctly perform research within the selected specialization and/or diploma project topic.               |                                                          |                                         |                                     |                                                                                                                                                |            |     |
|                                             | Becoming familiar with the basic aspects of the construction and operating principles of the research equipment used.              |                                                          |                                         |                                     |                                                                                                                                                |            |     |
|                                             | Introducing students to the fundamental computational methods related to the selected specialization and/or diploma project topic. |                                                          |                                         |                                     |                                                                                                                                                |            |     |
|                                             | Developing the ability to critically interpret the obtained results.                                                               |                                                          |                                         |                                     |                                                                                                                                                |            |     |
|                                             | Acquiring the ability to engage in creative discussion about issues and findings in forensic analyses.                             |                                                          |                                         |                                     |                                                                                                                                                |            |     |
|                                             | Developing the skills necessary for the proper preparation and execution of a diploma project.                                     |                                                          |                                         |                                     |                                                                                                                                                |            |     |

| Learning outcomes | Course outcome                                                                                                                                                                                                                     | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Method of verification                                                                                                        |
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|                   | [AKRL3_U08] The graduate is able to prepare oral and written presentations and reports in Polish and in chosen foreign language, as well as present and evaluate different viewpoints and engage in discussion in those languages. | The student is able to clearly and logically present their position regarding analysis results, research methods, or expert conclusions, both in Polish and in a foreign language.<br>The student is able to formulate constructive comments, evaluate differing opinions, and participate in substantive discussions in both languages while adhering to academic standards.<br>The student is able to synthesize information from scientific literature and present its analysis in the form of a presentation or report in Polish and in a foreign language.                                                                                                                                                                                                                                                                      | [SU2] prezentacja/projekt/referat/raport<br>[SU7] wpisy i opinia w dzienniczku praktyk                                        |
|                   | [AKRL3_W11] The graduate knows and understands the basic concepts and principles of intellectual property protection and copyright law, especially in relation to scientific, research and expert activities.                      | The student understands the principles of ethical and legally compliant use of third-party publications, data, research results, and expert materials.<br>The student can distinguish which elements of scientific and project work are legally protected (e.g., a creative work, data, invention, documentation).<br>The student is able to identify the legal obligations related to copyright when preparing reports, presentations, publications, and expert opinions.<br>The student knows the principles of preparing and sharing research documentation in accordance with legal requirements, including citation rules, licensing, and rights to research results.<br>The student is able to assess the risk of intellectual property infringement in research projects and expert analyses and propose preventive measures. | [SW2] prezentacja/projekt/referat/raport<br>[SW3] opracowanie tekstowe/praca pisemna<br>[SW5] realizacja zadania problemowego |
|                   | [AKRL3_U04] The graduate is able to select appropriate equipment for experiments and prepare reports and expert opinions based on analytical results in compliance with legal and ethical standards.                               | The student is able to analyze and interpret research results, identifying measurement errors, methodological limitations, and data reliability.<br>The student is able to prepare a complete research report, including a description of the equipment used, methodology, results, interpretation, and conclusions.<br>The student is able to prepare an expert opinion based on analytical data, in compliance with legal regulations and principles of scientific integrity.<br>The student is able to document the experimental process and interpretation of results in a clear, accurate, and formally compliant manner.                                                                                                                                                                                                       | [SU5] realizacja zadania problemowego                                                                                         |

|  | Course outcome                                                                                                                                                        | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Method of verification                                                                                                                                                                     |
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|  | [AKRL3_U03] The graduate is able to perform analyses using instrumental methods (spectroscopy, chromatography, microbiological tests) and interpret research results. | <p>The student is able to select an appropriate instrumental method (spectroscopic, chromatographic, or microbiological) for a given analytical problem.</p> <p>The student is able to properly prepare a sample for instrumental analyses in accordance with laboratory procedures and method requirements.</p> <p>The student is able to operate selected research equipment (e.g., spectrophotometer, spectrometer, chromatograph, microbiological incubator) in compliance with instructions and safety regulations.</p> <p>The student is able to perform instrumental measurements while ensuring procedural accuracy, parameter control, and minimization of analytical errors.</p> <p>The student is able to interpret data obtained from instrumental analyses, identify analytical signals, determine concentrations, construct calibration curves, and assess measurement quality.</p> <p>The student is able to recognize possible sources of error (instrumental, environmental, human) and evaluate their impact on the final result.</p> <p>Student is able to prepare a report on the conducted analyses, including a description of the method, instruments used, results, their interpretation, and conclusions.</p> <p>Student is able to critically assess the reliability and limitations of the applied instrumental method in relation to the analytical problem under investigation.</p> | <p>[SU5] realizacja zadania problemowego</p> <p>[SU6] demonstracja umiejętności praktycznych</p> <p>[SU8] obserwacja samodzielnej lub zespołowej pracy studenta</p>                        |
|  | [AKRL3_K02] The graduate is ready to make reliable, objective decisions and take responsibility for the interpretation of research results.                           | <p>The student is able to critically evaluate the quality of the obtained data, including assessing the precision, repeatability, and reliability of the applied research method.</p> <p>The student is aware of the responsibility associated with interpreting research results, especially those used in expert analyses or decision-making processes.</p> <p>The student is able to clearly justify the decisions made and the conclusions drawn, basing them on data analysis and established scientific standards.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>[SK1] wypowiedź ustna/rozmowa/ dyskusja</p> <p>[SK2] prezentacja/projekt/referat/ raport</p> <p>[SK4] test/egzamin - ustny lub pisemny</p> <p>[SK5] realizacja zadania problemowego</p> |
|  | [AKRL3_U12] The graduate is able to use a foreign language at the B2 level in the field of chemical and forensic terminology.                                         | <p>The student is able to read and understand scientific articles in the field of chemistry and forensic science in a foreign language at the B2 level.</p> <p>The student can correctly use specialized chemical and forensic terminology in spoken and written communication in a foreign language.</p> <p>The student can prepare written summaries, reports, or interpretations of research findings in a foreign language, maintaining appropriate terminology and clarity of expression.</p> <p>The student can actively participate in discussions related to chemical and forensic issues in a foreign language, formulating arguments and asking relevant questions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>[SU1] wypowiedź ustna/rozmowa/ dyskusja</p> <p>[SU3] opracowanie tekstowe/ praca pisemna</p>                                                                                            |

|                                 | Course outcome                                                                                                                                           | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Method of verification                                                                                                                                                                                            |
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|                                 | [AKRL3_U07] The graduate is able to communicate using specialist terminology in chemistry and forensic science while working in interdisciplinary teams. | <p>The student is able to effectively communicate information regarding research methods, analytical results, and conclusions in a way that is understandable to individuals from various fields, including those outside of chemistry.</p> <p>The student is able to collaborate within an interdisciplinary team, applying chemical and forensic knowledge to solve shared research problems.</p> <p>The student is able to adjust their communication style to the audience — whether a specialist, laboratory technician, law enforcement officer, or a professional from another field.</p> <p>The student is able to present the results of team work, analyze the opinions of group members, and participate in substantive discussions on proposed solutions.</p> <p>The student is able to formulate clear, factual, and scientifically accurate communications regarding procedures, risks, irregularities, and recommendations in the context of chemistry and forensic science.</p> <p>The student is able to co-create team documentation, such as protocols, reports, or procedural descriptions, using precise specialist terminology.</p> | <p>[SU2] prezentacja/projekt/referat/ raport</p> <p>[SU3] opracowanie tekstowe/ praca pisemna</p> <p>[SU5] realizacja zadania problemowego</p> <p>[SU8] obserwacja samodzielnej lub zespołowej pracy studenta</p> |
|                                 | [AKRL3_U09] The graduate is able to independently plan and implement their professional development and lifelong learning.                               | <p>Student develops the ability to think critically and assess the quality of information related to the research context and the evaluation of results.</p> <p>Through reading scientific texts, student learns to analyze and synthesize information, identify key concepts, and understand complex chemical issues.</p> <p>Student is able to define a clear goal or task they want to achieve.</p> <p>Student understands the need to independently search for information in scientific literature and is able to formulate appropriate questions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | [SU5] realizacja zadania problemowego                                                                                                                                                                             |
|                                 | [AKRL3_U11] The graduate is able to work effectively in a laboratory team while adhering to professional ethics and organisational rules.                | <p>The student is able to collaborate effectively within a team, developing the ability to listen, communicate, resolve conflicts, and take on various roles within the group. Effective teamwork contributes to achieving the team's goals.</p> <p>The student is able to resolve conflicts and misunderstandings within the team in a constructive manner, demonstrating respect for different opinions and working styles.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | [SU5] realizacja zadania problemowego                                                                                                                                                                             |
| Subject contents                | The course content is varied and tailored to the scope of the chosen specialization and/or the topic of the diploma project.                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                   |
| Prerequisites and co-requisites | Knowledge of the fundamental issues in chemical analytics and/or related scientific fields.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                   |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                 | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Percentage of the final grade                                                                                                                                                                                     |
|                                 | Preparation and delivery of several multimedia presentations related to the research topic being carried out.                                            | 100.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100.0%                                                                                                                                                                                                            |

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| Recommended reading                                            | Basic literature                                                                                                                          | <b>A. Literature required for the final completion of the course (passing the exam):</b><br><br><b>A.1. Used during classes</b><br>Books and scientific articles related to the chosen specialization and/or the diploma project topic.<br><br><b>A.2. Studied independently by the student</b><br>Books and scientific articles related to the chosen specialization and/or the diploma project topic. |
|                                                                | Supplementary literature                                                                                                                  | Books and scientific articles related to the chosen specialization and/or the diploma project topic.                                                                                                                                                                                                                                                                                                    |
|                                                                | eResources addresses                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example issues/<br>example questions/<br>tasks being completed | Solving research problems that arise during the implementation of the project (e.g., optimizing procedures, improving method efficiency). |                                                                                                                                                                                                                                                                                                                                                                                                         |
| Work placement                                                 | Not applicable                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                         |

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