

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                         |                                     |                        |            |     |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|------------------------|------------|-----|
| Subject name and code                       | Laboratory of biological samples analysis, PG_00156230                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                                         |                                     |                        |            |     |
| Field of study                              | Environmental Protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                         |                                     |                        |            |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | Academic year of realisation of subject |                                     | 2027/2028              |            |     |
| 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                 |            |     |
| Semester of study                           | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | ECTS credits                            |                                     | 1.0                    |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          | Assessment form                         |                                     |                        |            |     |
| Conducting unit                             | Department of Environmental Analysis -> Faculty of Chemistry -> Rector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                                         |                                     |                        |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | dr hab. Łukasz Haliński                 |                                     |                        |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                         |                                     |                        |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Lecture                                                  | Tutorial                                | Laboratory                          | Project                | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10.0                                                     | 0.0                                     | 0.0                                 | 0.0                    | 0.0        | 10  |
|                                             | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10                                                       |                                         | 2.0                                 |                        | 13.0       | 25  |
| Subject objectives                          | <div>1. To familiarize with the basic issues concerning the nature and diversity of biological samples;</div> <div>2. To familiarize with methods of extraction of organic compounds and planning of extraction procedures;</div> <div>3. To familiarize with methods of purifying extracts prior to analysis;</div> <div>4. To familiarize with screening methods and methods for final determinations;</div> <div>5. To introduce to the possibilities and limitations of analytical techniques;</div> <div>6. To develop the ability to independently design an analytical process;</div> <div>7. To introduce to the basics of method validation and determining method reliability.</div> |                                                          |                                         |                                     |                        |            |     |

|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Learning outcomes                                              | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Subject outcome                                                                                                                                                                                                                                                            | Method of verification                                                                                                    |
|                                                                | [OŚL3_U04] Uses specialist language in the discussion and properly uses the nomenclature in the field of environmental protection and individual disciplines related to it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The student discusses issues related to chemical analysis of biological samples in understandable language, using correct nomenclature.                                                                                                                                    | [SU4] test/exam - oral or written                                                                                         |
|                                                                | [OŚL3_W06] Characterises levels of life organization, biodiversity and the interaction of organisms and the environment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The student discusses the relationship between the results obtained from the analysis of compounds in biological samples and possible factors affecting these results.                                                                                                     | [SW4] test/exam - oral or written                                                                                         |
|                                                                | [OŚL3_K01] Behaves in a professional manner at all times; bears full responsibility for the actions taken relating to the protection of the environment and respects the principles of professional ethics and principles of intellectual honesty.                                                                                                                                                                                                                                                                                                                                                                                          | The student is able to evaluate the reliability of the analytical procedure on the basis of selected validation parameters; is careful in handling chemical substances and in handling measuring apparatus.                                                                | [SK4] test/exam - oral or written                                                                                         |
|                                                                | [OŚL3_W05] Explains the course of natural and anthropopressional physical, chemical and biological processes and phenomena occurring in nature at various levels of matter organisation.                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The student discusses issues related to chemical analysis of biological samples in understandable language, using correct nomenclature.                                                                                                                                    | [SW4] test/exam - oral or written                                                                                         |
|                                                                | [OŚL3_W02] Characterises the relationships and relationships between various disciplines of natural sciences and science, uses knowledge of mathematics, physics, chemistry and biology in the description of basic concepts, concepts and principles in environmental protection.                                                                                                                                                                                                                                                                                                                                                          | The student correctly solves tests and answers open questions on the knowledge of chemical analysis of biological samples and can propose a procedure for extraction and purification of test compounds based on their properties and the nature of the biological matrix; | [SW4] test/exam - oral or written                                                                                         |
| Subject contents                                               | [OŚL3_U01] Performs tasks under supervision and independently in the field of analysis of the natural environment and the functioning of natural and man-made natural systems.                                                                                                                                                                                                                                                                                                                                                                                                                                                              | The student is able to select an appropriate analytical procedure for the specificity of the compounds under study and the nature of the matrices                                                                                                                          | [SU4] test/exam - oral or written                                                                                         |
|                                                                | Characterization of biological samples - complexity of matrices, undesirable components, stability of tested compounds. Basics of extraction of compounds from biological matrices and purification of extracts. Screening and confirmatory analytical methods. Qualitative and quantitative analysis. Practical aspects of the application of selected techniques in the analysis of biological samples: UV/Vis spectrophotometry, liquid chromatography (LC, TLC, HPLC, UPLC), gas chromatography (GC), mass spectrometry (MS), combined techniques. Targeted, untargeted and group analyses. Basics of validation of analytical methods. |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                | Prerequisites and co-requisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                | Knowledge of the basics of general, inorganic, organic and analytical chemistry including: structure and physicochemical properties of basic groups of organic and inorganic compounds, knowledge of chemical nomenclature, ability to apply basic formulas from stoichiometry, calculation of concentrations of solutions, knowledge and ability to use laboratory glassware, operation of basic measuring instruments, application of safety rules for working in a chemical laboratory.                                                                                                                                                  |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                | Assessment methods and criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Subject passing criteria                                                                                                                                                                                                                                                   | Passing threshold                                                                                                         |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Written exam (60 min)                                                                                                                                                                                                                                                      | 51.0%                                                                                                                     |
| Recommended reading                                            | Percentage of the final grade                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                            | 100.0%                                                                                                                    |
|                                                                | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                            | Szczepaniak W. Metody instrumentalne w analizie chemicznej. PWN, Warszawa, 2005                                           |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            | Witkiewicz Z. Podstawy chromatografii, WNT, Warszawa, 2005.                                                               |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            | Namieśnik J., Jamrógielcz Z., Piłarczyk M., Torres L. Przygotowanie próbek środowiskowych do analiz. WNT, Warszawa, 2000. |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            | Namieśnik J., Łukasiak J., Jamrógielcz Z. Pobieranie próbek środowiskowych do analiz. PWN, Warszawa, 1995.                |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                            | Stepnowski P., Synak E., Szafranek B., Kaczyński Z. Techniki separacyjne. Wydawnictwo UG, Gdańsk, 2010                    |
| Example issues/<br>example questions/<br>tasks being completed | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                            | Adresy na platformie eNauczanie:                                                                                          |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |
|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                            |                                                                                                                           |

|                |                |
|----------------|----------------|
| Work placement | Not applicable |
|----------------|----------------|

Document generated electronically. Does not require a seal or signature.