

## Subject card

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| Subject name and code                       | Monographic lecture - Chemical analysis of complex samples, PG_00139935                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          |                                         |                                     |                                                                          |            |     |
| Field of study                              | Chemical Business                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                                         |                                     |                                                                          |            |     |
| Date of commencement of studies             | February 2026                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | Academic year of realisation of subject |                                     | 2026/2027                                                                |            |     |
| Education level                             | Master's studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          | Subject group                           |                                     | Obligatory subject group in the field of study<br>Optional subject group |            |     |
| Mode of study                               | full-time studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          | Mode of delivery                        |                                     | at the university                                                        |            |     |
| Year of study                               | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          | Language of instruction                 |                                     | Polish                                                                   |            |     |
| Semester of study                           | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          | ECTS credits                            |                                     | 3.0                                                                      |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | Assessment form                         |                                     | credit                                                                   |            |     |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30.0                                                     | 0.0                                     | 0.0                                 | 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                                 |                                                                          | 40.0       | 75  |
| Subject objectives                          | <div>1. To familiarize students with the nature and diversity of biological samples;</div> <div>2. To familiarize students with methods of extraction of organic compounds and planning of extraction;</div> <div>3. To familiarize students with methods of purifying extracts prior to instrumental analysis;</div> <div>4. To familiarize students with screening methods and confirmation methods;</div> <div>5. To introduce students to the possibilities and limitations of analytical techniques;</div> <div>6. To develop the ability to design an analytical process based on the nature of the samples;</div> <div>7. To introduce students to the method validation and determining method reliability.</div> |                                                          |                                         |                                     |                                                                          |            |     |

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| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Method of verification            |
|                                 | [BCHMU2_K04] Is willing to properly assess the acquired knowledge, respect and disseminate it in order to solve specific cognitive and practical issues.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Critically evaluates the data in the literature and the analytical results obtained.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [SK4] test/exam - oral or written |
|                                 | [BCHMU2_W01] Knows and understands complex physicochemical processes and is able to analyse their course in connection with other fields of science.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Presents and describes methods for limiting the effects of matrix components on assay results and the capabilities and limitations of basic analytical techniques.                                                                                                                                                                                                                                                                                                                                                                                                                  | [SW4] test/exam - oral or written |
|                                 | [BCHMU2_U02] Is able to define her/his interests, develop them within the chosen direction and in connection with the subject of her/his master's thesis by implementing the process of self-education and planning her/his professional career.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Evaluates the advantages and disadvantages of analytical techniques in the practical planning of an analytical procedure and is able to independently select the appropriate analytical approach to solve a problem.                                                                                                                                                                                                                                                                                                                                                                | [SU4] test/exam - oral or written |
|                                 | [BCHMU2_U01] Is able to, on the basis of her/his knowledge, propose a solution to problems in chemistry, taking into account the economic aspect by using advanced measurement techniques.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Plans analytical procedures based on the nature of the matrix and test compounds, taking into account the cost of the developed procedure and proposing to reduce it.                                                                                                                                                                                                                                                                                                                                                                                                               | [SU4] test/exam - oral or written |
|                                 | [BCHMU2_W05] Knows and understands the main trends in the development of chemistry combined with economics as two interpenetrating scientific disciplines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Plans analytical procedures as part of an industrial process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | [SW4] test/exam - oral or written |
| Subject contents                | <p>Characteristics of complex samples - biological samples, environmental samples, food samples. Characteristic groups of undesirable components (interferents). Removal of undesirable components: dialysis and chromatography of exclusion, liquid-liquid extraction, solid-phase extraction, liquid chromatography. Purification and fractionation of extracts. Practical aspects of analysis by chromatographic and spectroscopic techniques. Effects of undesirable components on analytical results: selectivity and specificity of methods, effects related to contamination of apparatus, matrix effects. Screening and confirmatory analytical methods. Issues related to qualitative and quantitative analysis. Targeted, untargeted and group analysis. Basics of validation of analytical methods for complex samples. Certified reference materials. A critical look at selected analytical methods and practical aspects of analytical process planning.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   |
| Prerequisites and co-requisites | <p>Completed courses: organic chemistry, analytical chemistry.</p> <p>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, calculation of solution concentrations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Percentage of the final grade     |
|                                 | Written exam (120 min)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100.0%                            |
| Recommended reading             | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>Szczepaniak W. Metody instrumentalne w analizie chemicznej. PWN, Warszawa, 2005</p> <p>Witkiewicz Z. Podstawy chromatografii, WNT, Warszawa, 2005.</p> <p>Namieśnik J., Jamróiewicz Z., Pilarczyk M., Torres L. Przygotowanie próbek środowiskowych do analiz. WNT, Warszawa, 2000.</p> <p>Namieśnik J., Łukasiak J., Jamróiewicz Z. Pobieranie próbek środowiskowych do analiz. PWN, Warszawa, 1995.</p> <p>Smyth W.F. Analytical chemistry of complex matrices. Wiley &amp; Teubner, Chichester, UK, 1996.</p> <p>Scientific papers dealing with the topic of the lecture.</p> |                                   |
|                                 | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>Stepnowski P., Synak E., Szafrank B., Kaczyński Z. Techniki separacyjne. Wydawnictwo UG, Gdańsk, 2010</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |
|                                 | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   |

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| Example issues/<br>example questions/<br>tasks being completed |                |
| Work placement                                                 | Not applicable |

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