

## Subject card

|                                             |                                                                                                          |                                                          |                                         |                                     |         |                                                                                                                      |     |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Analytical chemistry, PG_00052418                                                                        |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Field of study                              | Chemical Business                                                                                        |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Date of commencement of studies             | October 2025                                                                                             |                                                          | Academic year of realisation of subject |                                     |         | 2026/2027                                                                                                            |     |
| Education level                             | Bachelor's studies                                                                                       |                                                          | Subject group                           |                                     |         | Obligatory subject group in the field of study<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                               | 2                                                                                                        |                                                          | Language of instruction                 |                                     |         | Polish                                                                                                               |     |
| Semester of study                           | 3                                                                                                        |                                                          | ECTS credits                            |                                     |         | 3.0                                                                                                                  |     |
| Learning profile                            | academic                                                                                                 |                                                          | Assessment form                         |                                     |         | credit                                                                                                               |     |
| Conducting unit                             | Department of Analytical Chemistry -> Faculty of Chemistry -> Rector                                     |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                       |                                                          | dr Dorota Zarzeczkańska                 |                                     |         |                                                                                                                      |     |
|                                             | Teachers                                                                                                 |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Lesson types                                | Lesson type                                                                                              | Lecture                                                  | Tutorial                                | Laboratory                          | Project | Seminar                                                                                                              | SUM |
|                                             | Number of study hours                                                                                    | 0.0                                                      | 0.0                                     | 45.0                                | 0.0     | 0.0                                                                                                                  | 45  |
|                                             | 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                                                                                    | 45                                                       |                                         | 8.0                                 |         | 22.0                                                                                                                 | 75  |
| Subject objectives                          | acquiring the ability to independently conduct basic analyzes using qualitative and quantitative methods |                                                          |                                         |                                     |         |                                                                                                                      |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Method of verification                                                                                                                             |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | [BCHINŻ_W10] Applies safety and hygiene principles when working on a test and measurement stand or in the field.                                                                                                                                                                                                                                                                                                                                                                                                               | Characterizes the basic principles of health and safety procedures at the analytical laboratory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [SW4] test/exam - oral or written                                                                                                                  |
|                                 | [BCHINŻ_W02] Enumerates basic laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks.                                                                                                                                                                                                                                                                                                                                                                               | 1. Gives the composition of group reagents.<br>2. Explains the principle of operation of group and specific reagents.<br>3. Defines the basic issues of the theory describing the course of ionic reactions in solution.<br>4. Illustrates the titration process with an appropriate curve.<br>5. Illustrates and describes using chemical equations the reactions that occur during qualitative and quantitative determinations.<br>6. Lists and explains the operation of indicators used in titration determinations.                                                      | [SW4] test/exam - oral or written                                                                                                                  |
|                                 | [BCHINŻ_U08] Uses the chemical nomenclature and engineering terminology properly.                                                                                                                                                                                                                                                                                                                                                                                                                                              | Appropriately uses chemical nomenclature and engineering terminology typical of analytical chemistry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | [SU4] test/exam - oral or written                                                                                                                  |
|                                 | [BCHINŻ_W07] Describes the construction and operating principles of basic scientific, technological and control-measuring apparatus.                                                                                                                                                                                                                                                                                                                                                                                           | describes and can sketch laboratory equipment and glassware necessary to perform classical analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [SW4] test/exam - oral or written                                                                                                                  |
|                                 | [BCHINŻ_U03] Plans, selects the appropriate research and measuring equipment and performs simple chemical experiments; analyses the results and draws conclusions based on them.                                                                                                                                                                                                                                                                                                                                               | 1. plans and supplies laboratory equipment and glassware necessary to perform classical analysis<br>2. Based on the reactions carried out, identifies and classifies ions into appropriate analytical groups in accordance with the Fresenius and Bunsen taxonomy.<br>3. Performs alkalimetric, redoximetric, precipitation and complexometric titration determinations as well as gravimetric determinations in accordance with the analytical recipe.<br>4. Balances the equations of chemical reactions and uses them to calculate the amount of the determined substance. | [SU4] test/exam - oral or written<br>[SU7] entries and opinions in the internship diary<br>[SU8] observation of student's independent or team work |
|                                 | [BCHINŻ_K04] Demonstrates responsibility for the safety of her/his own and others' work.                                                                                                                                                                                                                                                                                                                                                                                                                                       | Recognizes and predicts sources of errors in analysis and follows occupational health and safety rules in the laboratory.                                                                                                                                                                                                                                                                                                                                                                                                                                                     | [SK8] observation of student's independent or team work                                                                                            |
| Subject contents                | Principles of work in the analytical laboratory, qualitative analysis of cations I, IIA and III of the Fresenius analytical groups and mixtures of anions, quantitative analysis of substances in solution (alkalimetry, redoximetry, complexometry, precipitation titration, weight analysis).                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                    |
| Prerequisites and co-requisites | -completed general chemistry course<br><br>-using basic laboratory glass and applying the rules of work in a chemical laboratory, writing chemical reactions taking into account the stoichiometry of reactions and determining the products, e.g. sediment, gas, etc., describing chemical equilibrium in the solution using chemical reactions, balancing the oxidation and reduction reactions; calculations based on chemical reactions, calculating molar concentrations, percentages, calculating the pH of electrolytes |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                    |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Percentage of the final grade                                                                                                                      |
|                                 | Completion of the practical part of the classes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 37.0%                                                                                                                                              |
|                                 | seven partial tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 56.0%                                                                                                                                              |
|                                 | report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7.0%                                                                                                                                               |

|                                                                |                          |                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended reading                                            | Basic literature         | <p>J. Minczewski i Z. Marczenko, Chemia analityczna 1 i 2, PWN Warszawa</p> <p>T. Lipiec, Z.S. Szmał, Chemia analityczna z elementami analizy instrumentalnej, PZWL Warszawa</p> <p>H. Bentkowska, Chemia analityczna jakościowa, skrypt PG</p> <p>A. Cygański, Chemiczne metody analizy ilościowej, WNT</p> <p>A. Persony, Chemia analityczna. Podstawy klasycznej analizy ilościowej, Medyk</p> |
|                                                                | Supplementary literature | <p>D. Harvey, Modern Analytical Chemistry, McGraw Hill Companies, Inc.</p> <p>W. Gorzelany, A. Śliwa, J. Wojciechowska, Półmikroanaliza jakościowa, PWN Warszawa</p>                                                                                                                                                                                                                              |
|                                                                | eResources addresses     |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example issues/<br>example questions/<br>tasks being completed |                          |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Work placement                                                 | Not applicable           |                                                                                                                                                                                                                                                                                                                                                                                                   |

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