

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Analytical chemistry, PG_00052417                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
| Field of study                              | Chemical Business                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
| Date of commencement of studies             | October 2026                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | Academic year of realisation of subject                                                                                                                                                                                                                                                       |                                     | 2027/2028                                                                                                            |            |     |
| 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                                                                                                                                                                                                                                                                                  |                                     | 2.0                                                                                                                  |            |     |
| 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 Zarzeczańska                                                                                                                                                                                                                                                                        |                                     |                                                                                                                      |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Lecture                                                  | Tutorial                                                                                                                                                                                                                                                                                      | Laboratory                          | Project                                                                                                              | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.0                                                      | 30.0                                                                                                                                                                                                                                                                                          | 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                                 |                                                                                                                      | 15.0       | 50  |
| Subject objectives                          | using chemical calculations to determine substances                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          | Subject outcome                                                                                                                                                                                                                                                                               |                                     | Method of verification                                                                                               |            |     |
|                                             | [BCHINŻ_W02] Enumerates basic laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks.                                                                                                                                                                                                                                                                                                                                                                               |                                                          | 1. Illustrates the titration process with an appropriate curve.<br>2. Illustrates and describes using chemical equations the reactions that occur during qualitative and quantitative determinations.<br>3. Selects a calculation method to determine the amount of a substance in a solution |                                     | [SW4] test/exam - oral or written                                                                                    |            |     |
|                                             | [BCHINŻ_U08] Uses the chemical nomenclature and engineering terminology properly.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | Correctly recognizes and uses the nomenclature used in analytical chemistry.                                                                                                                                                                                                                  |                                     | [SU1] oral statement/conversation/discussion<br>[SU4] test/exam - oral or written                                    |            |     |
| Subject contents                            | Calculation of: ion activity in solution, pH of solutions of substances and mixtures, redox potentials and EMF, oxidation and reduction reaction constant, solubility of precipitates taking into account the influence of ionic strength, protolysis and complexation, ion concentrations in solutions of complexes, titration results and curves (alkacimetric, redoximetric , complexometric and precipitation), errors and losses in quantitative analysis, predicting the direction of oxidation and reduction reactions. |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
| Prerequisites and co-requisites             | -completed general chemistry course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |
|                                             | -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                                            |                                                          |                                                                                                                                                                                                                                                                                               |                                     |                                                                                                                      |            |     |

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| Assessment methods and criteria | Subject passing criteria                                       | Passing threshold                                                                                                                                                                                            | Percentage of the final grade |
|                                 | arithmetic mean of two tests                                   | 51.0%                                                                                                                                                                                                        | 90.0%                         |
|                                 | activity                                                       | 0.0%                                                                                                                                                                                                         | 10.0%                         |
| Recommended reading             | Basic literature                                               | Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej, PWN<br><br>A. Cygański, Chemiczne metody analizy ilościowej, WNT<br><br>A. Persony , Chemia analityczna. Podstawy klasycznej analizy ilościowej, Medyk |                               |
|                                 | Supplementary literature                                       | D. Harvey, Modern Analytical Chemistry, McGraw Hill Companies, Inc.                                                                                                                                          |                               |
|                                 | eResources addresses                                           |                                                                                                                                                                                                              |                               |
|                                 | Example issues/<br>example questions/<br>tasks being completed |                                                                                                                                                                                                              |                               |
| Work placement                  | Not applicable                                                 |                                                                                                                                                                                                              |                               |

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