

# Basic analytical chemistry Educational subject description sheet

## **Basic information**

| Study programme<br>Chemia (General Chemistry)<br>Speciality<br>-<br>Organizational unit<br>Faculty of Chemistry<br>Study level<br>First-cycle programme |  | Didactic cycle<br>2024/25<br>Subject code<br>02CENS.13K.01808.24<br>Lecture languages<br>English<br>Course type<br>Obligatory |  |
|---|--|---|--|
| <b>Study form</b><br>Full-time  |  | <b>Block</b><br>Major subjects  |  |
| Education profile<br>General academic   |  |   |  |
| Subject coordinator   | Agata Szczeszak  |   |  |
| Lecturer  | Agata Szczeszak, Mikołaj Stodolny, Samanta Witomska  |   |  |
| <b>Period</b><br>Semester 1   | Activities and hoursNumber of<br>ECTS points• Lecture: 15, Exam; including sub-activities:<br>• Synchronous lecture: 155• Laboratories: 45, Graded credit5 |   |  |
| <b>Period</b><br>Semester 2   | Activities and hoursNumber of<br>ECTS points• Lecture: 30, ExamECTS points• Classes: 15, Graded credit8• Laboratories: 60, Graded credit8                  |   |  |

## Goals

| Code | Goal   |
|------|--|
| C1   | To ground the knowledge of the basics of chemistry.  |
| C2   | To provide knowledge on the basics of inorganic analytical chemistry and to make the students familiar with basic laboratory techniques used in quantitative and qualitative analysis. |
| С3   | To develop the ability to select the appropriate analytical method to solve issues related to the analytical determination.  |
| C4   | To develop the ability to perform basic calculations related to analytical chemistry.  |
| C5   | To develop the ability to evaluate test results correctly.   |
| C6   | To develop skills in independent laboratory work.  |
| C7   | To develop communication and teamwork skills.  |
| C8   | To consolidate and develop knowledge of health and safety and develop skills to apply it.  |

## **Entry requirements**

No prerequisites required.

# Subject learning outcomes

| Code                 | Outcomes in terms of  | Learning outcomes  | Examination methods                   |
|----------------------|---|--|---------------------------------------|
| Knowledge - Student: |   |  |                                       |
| W1                   | explains and applies the basic laws of analytical chemistry.  | CEN_K1_W01   | Written colloquium, Test              |
| Skills - Stu         | ident:  |  |                                       |
| U1                   | confidently uses classical methods of analytical chemistry.   | CEN_K1_U06,<br>CEN_K1_U07,<br>CEN_K1_U08,<br>CEN_K1_U18,<br>CEN_K1_U27 | Practical exam                        |
| U2                   | can apply the principles of health and safety in the laboratory.  | CEN_K1_U14   | Test, Practical exam                  |
| U3                   | selects appropriate conditions and appropriate<br>analytical techniques depending on the analyzed<br>component.   | CEN_K1_U04,<br>CEN_K1_U07,<br>CEN_K1_U16,<br>CEN_K1_U17,<br>CEN_K1_U18 | Practical exam                        |
| U4                   | performs calculations in the basic level area<br>(preparation of solutions of the desired concentration,<br>calculation of pH values) and calculations related to<br>the estimation of results. | CEN_K1_U08,<br>CEN_K1_U19  | Written colloquium,<br>Practical exam |
| U5                   | correctly carry out the analytical flow (sampling,<br>quantitative and qualitative analysis, interpretation of<br>results, writing a protocol).   | CEN_K1_U16,<br>CEN_K1_U17,<br>CEN_K1_U18,<br>CEN_K1_U19                | Practical exam                        |

| Code | Outcomes in terms of  | Learning outcomes                        | Examination methods                         |
|------|---|--|---|
| U6   | correctly interprets the results of analytical determinations.  | CEN_K1_U19,<br>CEN_K1_U25,<br>CEN_K1_U27 | Written colloquium, Test,<br>Practical exam |
| U7   | independently performs the analytical assessment in terms of qualitative and quantitative analysis.   | CEN_K1_U18,<br>CEN_K1_U26                | Practical exam                              |
| U8   | knows the names and formulas of chemical<br>compounds used in analytical chemistry and write<br>correctly the reactions that have been carried out. | CEN_K1_U01                               | Written colloquium, Test,<br>Practical exam |

# Study content

| No. | Course content  | Subject learning<br>outcomes | Activities  |
|-----|---|------------------------------|---|
| 1.  | Health and safety in the laboratory.  | U2                           | Laboratories  |
| 2.  | Fundamentals of inorganic analytical chemistry, basic laws, and relationships, chemical literature. | W1, U4, U7, U8               | Lecture, Classes,<br>Laboratories,<br>Synchronous lecture |
| 3.  | Laboratory equipment, laboratory glassware.   | U7                           | Lecture, Laboratories                                     |
| 4.  | Sampling for analysis, digestion.   | U1, U5, U7                   | Lecture, Laboratories                                     |
| 5.  | Practical use of classical analytical methods of qualitative and quantitative analysis.             | U1, U3, U5, U7               | Laboratories  |
| 6.  | Equilibrium in aqueous solutions.   | W1, U3, U4, U6               | Lecture, Classes,<br>Laboratories                         |
| 7.  | Weight analysis.  | U1, U4, U5, U7               | Lecture, Classes,<br>Laboratories,<br>Synchronous lecture |
| 8.  | Titration (volumetric) analysis.  | U4, U5, U6, U7, U8           | Lecture, Classes,<br>Laboratories,<br>Synchronous lecture |
| 9.  | Oxidation and reduction processes.  | U4, U5, U8                   | Lecture, Classes,<br>Laboratories,<br>Synchronous lecture |
| 10. | Calculations used in analytical chemistry and the basics of statistics.                             | U4                           | Classes, Laboratories,<br>Synchronous lecture             |
| 11. | Elaboration of the final report on the analytical determination carried out.                        | U5, U6                       | Laboratories  |
| 12. | Quick analytical methods.   | U1, U3                       | Laboratories  |

## Additional information

### Semester 1

| Activities | Teaching and learning methods and activities                                    |
|------------|---|
| Lecture    | Lecture with a multimedia presentation of selected issues, Conversation lecture |

| Activities   | Teaching and learning methods and activities  |  |
|--------------|---|--|
| Laboratories | Solving tasks (e.g. computational, artistic, practical), Laboratory method, Demonstration and observation |  |

| Activities   | Credit conditions   |
|--------------|---|
| Lecture      | <ul> <li>The prerequisite for taking the exam is obtaining a positive grade from laboratory exercises.</li> <li>The exam consists of test questions.</li> <li>Grading scale with applied percentage distribution: <ul> <li>excellent (5.0): achievement of the student's expected learning outcomes at a minimum of 92.0%.</li> <li>very good (4.5): achievement by the student of the desired learning outcomes ranging from 84.0% - 91.9%.</li> <li>good (4.0): achievement of student learning outcomes 76.0% - 83.9%.</li> <li>average (3.5): achievement of student learning outcomes 68.0% - 75.9%.</li> <li>satisfactory (3.0): attainment of the student to achieve the expected learning outcomes below 60.0%.</li> </ul> </li> </ul>  |
| Laboratories | <ul> <li>Completion of all practical analyses provided in the program.</li> <li>Passing all the colloquies.</li> <li>Grading scale with applied percentage distribution: <ul> <li>excellent (5.0): achievement of the student's expected learning outcomes at a minimum of 92.0%.</li> <li>very good (4.5): achievement by the student of the desired learning outcomes ranging from 84.0% - 91.9%.</li> <li>good (4.0): achievement of student learning outcomes 76.0% - 83.9%.</li> <li>average (3.5): achievement of student learning outcomes 68.0% - 75.9%.</li> <li>satisfactory (3.0): attainment of the student learning outcomes within 60.0% - 67.9%.</li> <li>unsatisfactory (2.0): failure of the student to achieve the expected learning outcomes below 60.0%.</li> </ul> </li> </ul> |

## Semester 2

| Activities   | Teaching and learning methods and activities  |  |
|--------------|---|--|
| Lecture      | Lecture with a multimedia presentation of selected issues, Conversation lecture                           |  |
| Classes      | Solving tasks (e.g. computational, artistic, practical), Classes method                                   |  |
| Laboratories | Solving tasks (e.g. computational, artistic, practical), Laboratory method, Demonstration and observation |  |

| Activities | Credit conditions   |
|------------|---|
| Lecture    | <ul> <li>The prerequisite for taking the exam is obtaining a positive grade from laboratory exercises. The exam consists of test questions.</li> <li>Grading scale with applied percentage distribution: <ul> <li>excellent (5.0): achievement of the student's expected learning outcomes at a minimum of 92.0%.</li> <li>very good (4.5): achievement by the student of the desired learning outcomes ranging from 84.0% - 91.9%.</li> <li>good (4.0): achievement of student learning outcomes 76.0% - 83.9%.</li> <li>average (3.5): achievement of student learning outcomes 68.0% - 75.9%.</li> <li>satisfactory (3.0): attainment of the student to achieve the expected learning outcomes below 60.0%.</li> </ul> </li> </ul> |

| Activities   | Credit conditions   |
|--------------|---|
| Classes      | <ul> <li>Passing all the colloquies.</li> <li>Grading scale with applied percentage distribution: <ul> <li>excellent (5.0): achievement of the student's expected learning outcomes at a minimum of 92.0%.</li> <li>very good (4.5): achievement by the student of the desired learning outcomes ranging from 84.0% - 91.9%.</li> <li>good (4.0): achievement of student learning outcomes 76.0% - 83.9%.</li> <li>average (3.5): achievement of student learning outcomes 68.0% - 75.9%.</li> <li>satisfactory (3.0): attainment of the student learning outcomes within 60.0% - 67.9%.</li> </ul> </li> </ul>   |
| Laboratories | <ul> <li>Completion of all practical analyses provided in the program.</li> <li>Passing all the colloquies.</li> <li>Grading scale with applied percentage distribution: <ul> <li>excellent (5.0): achievement of the student's expected learning outcomes at a minimum of 92.0%.</li> <li>very good (4.5): achievement by the student of the desired learning outcomes ranging from 84.0% - 91.9%.</li> <li>good (4.0): achievement of student learning outcomes 76.0% - 83.9%.</li> <li>average (3.5): achievement of student learning outcomes 68.0% - 75.9%.</li> <li>satisfactory (3.0): attainment of the student to achieve the expected learning outcomes below 60.0%.</li> </ul> </li> </ul> |

## Literature

#### Obligatory

1. Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R.Crouch "Fundamental of Analytical Chemistry"

#### Optional

1. F. W. Fifield and D.Kealey "Principles and Practice of Analytical Chemistry"

## **Calculation of ECTS points**

#### Semester 1

| Activities                       | Activity hours*     |  |
|----------------------------------|---------------------|--|
| Lecture                          | 15                  |  |
| Laboratories                     | 45                  |  |
| Preparation for the exam         | 30                  |  |
| Preparation for classes          | 15                  |  |
| Reading the indicated literature | 30                  |  |
|                                  |                     |  |
| Student workload                 | <b>Hours</b><br>135 |  |
| Number of ECTS points            | <b>ECTS</b><br>5    |  |

### Semester 2

| Activities                       | Activity hours* |
|----------------------------------|-----------------|
| Lecture                          | 30              |
| Classes                          | 15              |
| Laboratories                     | 60              |
| Preparation for the exam         | 45              |
| Preparation for classes          | 45              |
| Reading the indicated literature | 30              |
|                                  |                 |
| Student workload                 | Hours<br>225    |
| Number of ECTS points            | ECTS<br>8       |

\* academic hour = 45 minutes

# Efekty uczenia się dla kierunku

| Kod        | Treść   |
|------------|---|
| CEN_K1_U01 | The graduate can use basic chemical terminology according to IUPAC and PTChem recommendations   |
| CEN_K1_U04 | The graduate can plan the implementation of chemical processes in terms of the choice of reagents and elimination of the side products formed                 |
| CEN_K1_U06 | The graduate can carry out chemical reactions reflecting technological processes on a laboratory scale  |
| CEN_K1_U07 | The graduate can analyse simple process diagrams  |
| CEN_K1_U08 | The graduate can apply mathematical methods in chemical and physicochemical calculations  |
| CEN_K1_U14 | The graduate can work in a chemical laboratory according to health and safety rules   |
| CEN_K1_U16 | The graduate can apply analytical techniques to explain basic chemical and physicochemical phenomena  |
| CEN_K1_U17 | The graduate can select instrumental analysis methods to investigate specific chemical and physicochemical phenomena  |
| CEN_K1_U18 | The graduate can perform a chemical and physicochemical experiment based on the description   |
| CEN_K1_U19 | The graduate can analyse and develop test results and prepare a final report on the chemical and physico-<br>chemical experiments carried out                 |
| CEN_K1_U25 | The graduate can create a presentation of a specific chemical or physicochemical problem and propose a solution to it   |
| CEN_K1_U26 | The graduate can carry out simple research tasks or expert opinions under the guidance of a mentor  |
| CEN_K1_U27 | The graduate can demonstrate the ability to make correct inferences on the basis of data from chemical or physico-chemical experiments and literature sources |
| CEN_K1_W01 | The graduate knows and understands basic chemical laws and issues   |