

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                   |                                                          |                                         |                                     |         |                                                                                                                      |     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Instrumental analysis, PG_00054399                                                                                                                                                                                                                                                                                                                |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Field of study                              | Chemistry                                                                                                                                                                                                                                                                                                                                         |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Date of commencement of studies             | October 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>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                               | 1                                                                                                                                                                                                                                                                                                                                                 |                                                          | Language of instruction                 |                                     |         | Polish                                                                                                               |     |
| Semester of study                           | 1                                                                                                                                                                                                                                                                                                                                                 |                                                          | 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 hab. Grzegorz Romanowski             |                                     |         |                                                                                                                      |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                          |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                       | Lecture                                                  | Tutorial                                | Laboratory                          | Project | Seminar                                                                                                              | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                             | 0.0                                                      | 0.0                                     | 30.0                                | 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                          | familiarize students with the principles of electroanalytical, spectroscopic and chromatographic methods and stages of the analytical process, developing the ability to conduct basic analyses instrumental and their statistical evaluation, developing the ability to solve problems independently problems when conducting chemical analysis. |                                                          |                                         |                                     |         |                                                                                                                      |     |

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| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                              | Subject outcome                                                                                                                                                                                                                                                                | Method of verification                                                                                                         |
|                                 | [CHEMMU2_W09] Classifies specialist IT tools used in statistical evaluation of experiment results.                                                                                                                                                                                                                          | 1. Uses appropriate software for measurements and data processing.<br>2. Knows how to statistically evaluate experimental results.                                                                                                                                             | [SW2] presentation/project/paper/report<br>[SW3] text preparation/written work                                                 |
|                                 | [CHEMMU2_U04] Applies acquired knowledge of chemistry and related scientific disciplines.                                                                                                                                                                                                                                   | 1. Uses basic formulas to calculate the amount of analyte.<br>2. Carry out the measurement in accordance with the instructions for the exercise.                                                                                                                               | [SU2] presentation/project/paper/report<br>[SU3] text preparation/written work                                                 |
|                                 | [CHEMMU2_W10] Uses knowledge of the principles of operation of the basic scientific and research apparatus used in chemistry.                                                                                                                                                                                               | 1. Knows scientific and research equipment and knows what analytical tasks it can be used for.<br>2. Knows how it works and how to use it.                                                                                                                                     | [SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report<br>[SW3] text preparation/written work |
|                                 | [CHEMMU2_W02] Has extended and in-depth knowledge in the field of basic chemistry.                                                                                                                                                                                                                                          | 1. Defines the basic laws in electroanalytical, spectroscopic and chromatographic methods.<br>2. Describes the structure and principles of operation of the equipment used in the above-mentioned methods.                                                                     | [SW2] presentation/project/paper/report<br>[SW3] text preparation/written work                                                 |
|                                 | [CHEMMU2_U02] Critically assesses the results of conducted, performed observations and theoretical calculations and discusses errors.                                                                                                                                                                                       | 1. Interprets the results in qualitative and quantitative terms, including their statistical processing.<br>2. Recognizes and operates the equipment used in the analytical laboratory.                                                                                        | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report<br>[SU3] text preparation/written work |
|                                 | [CHEMMU2_W07] Selects experimental and theoretical techniques to the extent necessary to understand the description and modelling of medium complexity chemical processes.                                                                                                                                                  | 1. Explains and explains the principles of conducting analyzes using various instrumental techniques.<br>2. Recognizes the limitations of using each method.                                                                                                                   | [SW2] presentation/project/paper/report<br>[SW3] text preparation/written work                                                 |
|                                 | [CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.                                                                                                                                                                             | 1. Demonstrates an active attitude when faced with an analytical problem.<br>2. Demonstrates the ability to critically evaluate the analysis performed and the results obtained.<br>3. Takes care of the equipment used and the environment (disposal of chemical wastewater). | [SK1] oral statement/conversation/discussion<br>[SK2] presentation/project/paper/report                                        |
|                                 | [CHEMMU2_W03] Demonstrates extended knowledge in the field of modern measuring techniques used in chemical analysis.                                                                                                                                                                                                        | 1. Selects an analytical method for a specific sample.<br>2. Explains the principles of sample preparation for analysis.                                                                                                                                                       | [SW2] presentation/project/paper/report<br>[SW3] text preparation/written work                                                 |
| Subject contents                | Basics of laboratory work with equipment, performing chemical determinations and analyzes related to spectroscopic methods (UV-Vis spectroscopy), chromatographic methods (gas chromatography) and electroanalytical methods (potentiometry, conductometry, coulometry, polarography, voltammetry, amperometric titration). |                                                                                                                                                                                                                                                                                |                                                                                                                                |
| Prerequisites and co-requisites | knowledge of chemical methods of qualitative and quantitative analysis                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                |                                                                                                                                |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                    | Passing threshold                                                                                                                                                                                                                                                              | Percentage of the final grade                                                                                                  |
|                                 | report                                                                                                                                                                                                                                                                                                                      | 51.0%                                                                                                                                                                                                                                                                          | 35.0%                                                                                                                          |
|                                 | test                                                                                                                                                                                                                                                                                                                        | 51.0%                                                                                                                                                                                                                                                                          | 65.0%                                                                                                                          |
| Recommended reading             | <p>Basic literature</p> <p>W. Szczepaniak Metody instrumentalne w analizie chemicznej, PWN, WarszawaA. Cygański Metody spektroskopowe w chemii analitycznej, WNT, WarszawaA. Cygański Podstawy metod elektroanalitycznych, WNT, Warszawa</p>                                                                                |                                                                                                                                                                                                                                                                                |                                                                                                                                |

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|                                                                | Supplementary literature | G.W. Ewing Metody instrumentalne w analizie chemicznej, PWN, Warszawa J. Minczewski, Z. Marczenko Chemia analityczna t. III Analiza instrumentalna, PWN, Warszawa D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch Podstawy chemii analitycznej, PWN, Warszawa J. Garaj Fizyczne i fizykochemiczne metody analizy, WNT, Warszawa |
|                                                                | eResources addresses     |                                                                                                                                                                                                                                                                                                                                 |
| Example issues/<br>example questions/<br>tasks being completed |                          |                                                                                                                                                                                                                                                                                                                                 |
| Work placement                                                 | Not applicable           |                                                                                                                                                                                                                                                                                                                                 |

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