



## Subject card

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|---|--|--|---|------------|--|--|-----|
| Subject name and code                       | Analytical Chemistry , PG_00048460   |  |   |            |  |  |     |
| Field of study                              | Chemistry in Construction Engineering  |  |   |            |  |  |     |
| Date of commencement of studies             | October 2020   | Academic year of realisation of subject                  |   |            | 2021/2022  |  |     |
| Education level                             | first-cycle 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   |   |            | 5.0  |  |     |
| Learning profile                            | general academic profile   | Assessment form  |   |            | exam   |  |     |
| Conducting unit                             | Department of Analytical Chemistry -> Faculty of Chemistry   |  |   |            |  |  |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor   | prof. dr hab. inż. Andrzej Wasik                         |   |            |  |  |     |
|   | Teachers   | prof. dr hab. inż. Andrzej Wasik<br>dr inż. Paweł Kubica |   |            |  |  |     |
| Lesson types and methods of instruction     | Lesson type  | Lecture  | Tutorial  | Laboratory | Project  | Seminar  | SUM |
|   | Number of study hours  | 30.0   | 15.0  | 30.0       | 0.0  | 0.0  | 75  |
|   | E-learning hours included: 0.0<br>Adresy na platformie eNauczanie:   |  |   |            |  |  |     |
| 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  | 75   | 4.0   |            | 46.0   |  | 125 |
| Subject objectives                          | To acquaint students with the importance of analytical chemistry. To provide knowledge about the basics of classical analytical chemistry and selected instrumental analysis methods. The acquisition by the students ability to perform calculations for analysis problems. The acquisition of practical knowledge of basic analytical reactions and classical techniques of quantitative analysis. |  |   |            |  |  |     |
| Learning outcomes                           | Course outcome   |  | Subject outcome   |            |  | Method of verification   |     |
|   | K6_U08   |  | Student uses properly selected methods and devices that enable the measurement of basic quantities characterizing materials and technological processes.  |            |  |  |     |
|   | K6_K03   |  | Student solves the most common problems associated with the profession of engineer, correctly identifies and resolves dilemmas associated with the profession of engineer, assesses the risks and is able to assess the effects of her/his activities.  |            |  | [SK5] Assessment of ability to solve problems that arise in practice |     |
|   | K6_W03   |  | Student has established theoretical knowledge in the field of chemistry including analytical chemistry, including the knowledge necessary to describe and understand the phenomena and chemical processes occurring in the construction industry and to measure and characterize these processes. |            |  | [SW1] Assessment of factual knowledge                                |     |

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| Subject contents                | Lecture: The role and the place and tasks chemical analytical process, signal analytical; the collection and preparation of samples for analysis; the analytical methods (primary methods and absolute, indirect method); bases theoretical selected and a description of the analytical methods (gravimetry, volumetry, titration, redoxometry, complexometry, electroanalytical techniques, spectroscopic techniques ; chromatographic techniques, characteristics of the analytical method- validation parameters. The Seminar: Presentation of analytical result, the uncertainty, significant figures; gravimetric analysis, volumetric techniques, titration curves calculation; bases statistics in chemical metrology. Laboratory: Health and safety rules, the correct weighing, handling of volumetric equipment; adjustment titre NaOH; determination of H <sub>2</sub> SO <sub>4</sub> content by titration technique; determination of CH <sub>3</sub> COOH content; the determination of Cl <sup>-</sup> in the water-precipitation titration; the determination of iron- gravimetric analysis; the determination of Ca and Mg side by side-complexometry; the determination of Cu-redoxometric and electrogravimetric titration; statistical treatment of analytical results; electroanalytical techniques; spectroscopic techniques; gas chromatography; liquid chromatography. |  |                               |
| Prerequisites and co-requisites | Student should have knowledge of the: stoichiometry, chemical reaction equilibrium, reactions and theory of acids and bases, precipitation reaction, solubility product, reaction mechanism, complex formation constant   |  |                               |
| Assessment methods and criteria | Subject passing criteria  | Passing threshold  | Percentage of the final grade |
|                                 | Practical exercise  | 60.0%  | 35.0%                         |
|                                 | Written exam  | 60.0%  | 35.0%                         |
|                                 | Exercises   | 60.0%  | 30.0%                         |
| Recommended reading             | Basic literature  | 1. J. Minczewski, Z. Marczenko, Chemia analityczna t.1 Podstawy teoretyczne i analiza ilościowa, PWN, Warszawa 2006. 2. J. Minczewski, Z. Marczenko, Chemia analityczna t. 2, Chemiczne metody analizy ilościowej, PWN, Warszawa 2006. 3. Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej, PWN, Warszawa 2007. 4. A. Cygański, Chemiczne metody analizy ilościowej, WNT, Warszawa 1999. 5. W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 2008. 6. Ocena i kontrola jakości wyników pomiarów analitycznych, praca zbiorowa pod redakcją Piotra Konieczki i Jacka Namieśnika, WNT, Warszawa, 2007.         |                               |
|                                 | Supplementary literature  | 1. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy chemii analitycznej z CD-ROM. T. 1, PWN, Warszawa 2006 2. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy chemii analitycznej z CD-ROM. T. 2, PWN, Warszawa 2007 3. A. Cygański, Metody spektroskopowe w chemii analitycznej, WNT, Warszawa, 2002. 4. A. Cygański, Chemiczne metody analizy ilościowej, WNT, Warszawa, 2005. 5. Z. Witkiewicz, J. Hepter, Chromatografia gazowa, WNT, Warszawa, 2009. 6. Z. Witkiewicz, Podstawy chromatografii, WNT, Warszawa, 2005. 7. M. Wesółowski, K. Szefer, D. Zimna, Zbiór zadań z analizy chemicznej, WNT, Warszawa, 2002. |                               |
|                                 | eResources addresses  |  |                               |

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| <p>Example issues/<br/>example questions/<br/>tasks being completed</p> | <ol style="list-style-type: none"> <li>1. Simple conversions within molar and percentage concentrations.</li> <li>2. Sampling for analysis.</li> <li>3. Correct presentation of the analysis result, rounding of numbers.</li> <li>4. Estimating the uncertainty of the analysis result, theoretical and empirical approach.</li> <li>5. Phenomena occurring during precipitation.</li> <li>6. Acid-base titration, titration curves, indicators, pH buffers.</li> <li>7. Argentometry, titration curves, indicators.</li> <li>8. Redoxometry, titration curves, indicators, popular redoxometric methods.</li> <li>9. Complexometry, types and formation of complexes, application of complexometry in analysis.</li> <li>10. Spectroscopic methods.</li> <li>11. Validation of analytical methodologies.</li> <li>12. Introduction to chromatography.</li> <li>13. Selected electroanalytical methods</li> </ol> |
| <p>Work placement</p>   | <p>Not applicable</p>  |