

## Chemical technology

### Educational subject description sheet

#### Basic information

|   |  |   |
|---|--|---|
| <b>Study programme</b><br>Chemistry<br><b>Speciality</b><br>-<br><b>Organizational unit</b><br>Faculty of Chemistry<br><b>Study level</b><br>Second-cycle programme<br><b>Study form</b><br>Full-time<br><b>Education profile</b><br>General academic |  | <b>Didactic cycle</b><br>2023/24<br><b>Subject code</b><br>02CHSS.21P.00975.23<br><b>Lecture languages</b><br>English<br><b>Course type</b><br>Obligatory<br><b>Block</b><br>Basic subjects |
| <b>Subject coordinator</b>  | Maciej Trejda  |   |
| <b>Lecturer</b>   | Maciej Trejda, Ewa Janiszewska, Agnieszka Held   |   |
| <b>Period</b><br>Semester 1   | <b>Activities and hours</b> <ul style="list-style-type: none"> <li>Lecture: 15, Exam; including sub-activities:           <ul style="list-style-type: none"> <li>Synchronous lecture: 15</li> </ul> </li> <li>Field classes: 15, Graded credit</li> <li>Laboratories: 30, Graded credit</li> </ul> | <b>Number of ECTS points</b><br>7   |

#### Goals

| Code | Goal  |
|------|---|
| C1   | The aim of the course is detail presentation of common and modern technological processes related to the transformation of raw materials and production of different chemicals agents and substrates. |

## Entry requirements

No prerequisites required.

## Subject learning outcomes

| Code                                 | Outcomes in terms of  | Learning outcomes         | Examination methods                            |
|--------------------------------------|---|---------------------------|--|
| <b>Knowledge - Student:</b>          |   |                           |  |
| W1                                   | knows and understands the main processes used in chemical technology.   | CHS_K2_W01,<br>CHS_K2_W08 | Written exam, Written colloquium, Test         |
| W2                                   | knows and understands the analytical techniques used in chemical technology to resolve research problem.  | CHS_K2_W07,<br>CHS_K2_W08 | Written exam                                   |
| W3                                   | knows and understands terminology and nomenclature typical for chemical technology.   | CHS_K2_W01,<br>CHS_K2_W08 | Written exam, Written colloquium               |
| W4                                   | knows and understands traditional and novel processes used in chemical technology.  | CHS_K2_W08                | Written exam, Written colloquium, Test, Report |
| <b>Skills - Student:</b>             |   |                           |  |
| U1                                   | is able to enumerates and describes the main processes used in chemical technology.   | CHS_K2_U04,<br>CHS_K2_U11 | Written exam, Written colloquium               |
| U2                                   | is able to selects and applies the analytical techniques used in chemical technology to resolve research problem.                                 | CHS_K2_U02,<br>CHS_K2_U06 | Written exam, Test                             |
| U3                                   | is able to uses terminology and nomenclature typical for chemical technology.   | CHS_K2_U01,<br>CHS_K2_U04 | Written exam                                   |
| U4                                   | is able to describes and explains traditional and novel processes used in chemical technology.  | CHS_K2_U11,<br>CHS_K2_U14 | Written exam, Written colloquium, Report       |
| U5                                   | is able to selects the proper reagents for technological processes in order to obtain a target product.   | CHS_K2_U03,<br>CHS_K2_U11 | Test   |
| U6                                   | is able to uses a different literature data to enlarge his/her knowledge concerning chemical technology and well as to resolve research problems. | CHS_K2_U08,<br>CHS_K2_U13 | Report   |
| U7                                   | is able to performs a critical evaluation of research results, draws the conclusions and prepares the research report.                            | CHS_K2_U07,<br>CHS_K2_U12 | Report   |
| U8                                   | is able to applies the principle of occupational health and safety in the laboratory.   | CHS_K2_U15                | Observation                                    |
| <b>Social competences - Student:</b> |   |                           |  |
| K1                                   | is ready to apply critical evaluation of research results.  | CHS_K2_K02                | Written exam                                   |

## Study content

| No. | Course content  | Subject learning outcomes  | Activities                   |
|-----|---|----------------------------|------------------------------|
| 1.  | Occupational health and safety in the laboratory.   | U8                         | Laboratories                 |
| 2.  | Processes of inorganic technology (production of sulphur, nitrogen and phosphorus compounds). | W1, W3, W4, U1, U3, U4, U6 | Lecture, Synchronous lecture |

| No. | Course content   | Subject learning outcomes  | Activities                                  |
|-----|--|----------------------------|---|
| 3.  | Processing of fossil fuels.  | W1, W3, W4, U1, U3, U4, U6 | Lecture, Synchronous lecture                |
| 4.  | Processes of organic chemistry (production of methanol, aldehydes, epoxides).                                      | W1, W3, W4, U1, U3, U4, U6 | Lecture, Synchronous lecture                |
| 5.  | Processes based on renewable sources (biofuels, biofuel' additives, valuable chemicals).                           | W1, W3, W4, U1, U3, U4, U6 | Lecture, Synchronous lecture                |
| 6.  | Ecological aspects of chemical technology.   | W1, W3, W4, U1, U3, U4, U6 | Lecture, Field classes, Synchronous lecture |
| 7.  | Analytical techniques used to design and control technological processes (chemical, spectral and chromatographic). | W2, U2, U6                 | Laboratories                                |
| 8.  | Conducting of technological processes in laboratory scale.   | U2, U5, U7, U8, K1         | Laboratories                                |

### Additional information

| Activities    | Teaching and learning methods and activities              |
|---------------|---|
| Lecture       | Lecture with a multimedia presentation of selected issues |
| Field classes | Demonstration and observation                             |
| Laboratories  | Laboratory method   |

| Activities    | Credit conditions   |
|---------------|---|
| Lecture       | <p>The exam will be in written form (open question and test).<br/>Grading scale with applied percentage distribution:</p> <ul style="list-style-type: none"> <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% to 91.9%.</li> <li>• good (4.0): achievement of student learning outcomes 76% to 83.9%.</li> <li>• average (3.5): achievement of student learning outcomes 68% to 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> |
| Field classes | <p>The report is necessary to pass the field classes.<br/>Grading scale with applied percentage distribution:</p> <ul style="list-style-type: none"> <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% to 91.9%.</li> <li>• good (4.0): achievement of student learning outcomes 76% to 83.9%.</li> <li>• average (3.5): achievement of student learning outcomes 68% to 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>         |

| Activities   | Credit conditions  |
|--------------|--|
| Laboratories | <p>Occupational health and safety - formative assessment.<br/> The final grade is the average of the grades obtained from individual exercises, and each of the exercises must be passed with a positive grade.<br/> Grading scale with applied percentage distribution:</p> <ul style="list-style-type: none"> <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% to 91.9%.</li> <li>• good (4.0): achievement of student learning outcomes 76% to 83.9%.</li> <li>• average (3.5): achievement of student learning outcomes 68% to 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> |

## Literature

### Obligatory

1. A. Jess, P. Wasserscheid „Chemical Technology", John Wiley & Sons. Inc., 2013. (selected paragraphs)

### Optional

1. C. H. Bartholomew, R. J. Farrauto „Fundamentals of Industrial Catalytic Processes", John Wiley & Sons. Inc., 2005. (selected paragraphs)
2. R. A. van Santen, M. Neurock „Molecular Heterogeneous Catalysis – A conceptual and Computational Approach", Wiley-VCH, 2006. (selected paragraphs)
3. J. M. Thomas, W. J. Thomas „Principles and Practice of Heterogeneous Catalysis", Wiley-VCH, Second Edition, 1997. (selected paragraphs)

## Calculation of ECTS points

| Activities                       | Activity hours*     |
|----------------------------------|---------------------|
| Lecture                          | 15                  |
| Field classes                    | 15                  |
| Laboratories                     | 30                  |
| Reading the indicated literature | 30                  |
| Preparation for classes          | 45                  |
| Preparation for the exam         | 60                  |
| Report preparation               | 15                  |
| <b>Student workload</b>          | <b>Hours</b><br>210 |
| <b>Number of ECTS points</b>     | <b>ECTS</b><br>7    |

\* academic hour = 45 minutes

## Efekty uczenia się dla kierunku

| Kod        | Treść   |
|------------|---|
| CHS_K2_K02 | The graduate is ready to evaluate the collected information critically  |
| CHS_K2_U01 | The graduate can use chemical terminology consistent with IUPAC recommendations   |
| CHS_K2_U02 | The graduate can analyze the physicochemical properties of substances based on the selection of appropriate methods and tools   |
| CHS_K2_U03 | The graduate can carry out chemical processes including the selection of reagents and purification of products  |
| CHS_K2_U04 | The graduate can interpret technological diagrams and carry out technological processes on a laboratory scale   |
| CHS_K2_U06 | The graduate can use analytical and instrumental techniques to describe the qualitative and quantitative interpretation of chemical phenomena                               |
| CHS_K2_U07 | The graduate can prepare a final report on conducted research projects and conduct a critical analysis of experiments   |
| CHS_K2_U08 | The graduate can find and use information obtained from databases and literature resources in order to plan and carry out a research project                                |
| CHS_K2_U11 | The graduate can present a complex chemical or physicochemical problem and propose a solution   |
| CHS_K2_U12 | The graduate can draw conclusion properly and evaluate critically on the basis of data from self-conducted chemical or physicochemical experiments and literature resources |
| CHS_K2_U13 | The graduate can deepens his specialistic knowledge to the extent necessary to solve and interpret the undertaken problem correctly   |
| CHS_K2_U14 | The graduate can express in an accessible way the acquired knowledge, conduct a debate and present the results of scientific projects in chemistry                          |
| CHS_K2_U15 | The graduate can work in a group, performing various roles, including a leader  |
| CHS_K2_W01 | The graduate knows and understands selected advanced issues in the field of chemistry   |
| CHS_K2_W07 | The graduate knows and understands classifies advanced laboratory, analytical and instrumental techniques used in chemistry   |
| CHS_K2_W08 | The graduate knows and understands advanced chemical technology processes   |