

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                         |                                     |         |                                                                                                                      |     |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Environmental protection in chemical industry, PG_00073508                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Field of study                              | Chemical Business                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Date of commencement of studies             | October 2026                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | Academic year of realisation of subject |                                     |         | 2029/2030                                                                                                            |     |
| 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                               | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | Language of instruction                 |                                     |         | Polish                                                                                                               |     |
| Semester of study                           | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | ECTS credits                            |                                     |         | 1.0                                                                                                                  |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          | Assessment form                         |                                     |         | credit                                                                                                               |     |
| Conducting unit                             | Laboratory of Photocatalysis -> Department of Environmental Technology -> Faculty of Chemistry -> Rector                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | dr inż. Anna Malankowska                |                                     |         |                                                                                                                      |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                         |                                     |         |                                                                                                                      |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Lecture                                                  | Tutorial                                | Laboratory                          | Project | Seminar                                                                                                              | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.0                                                      | 0.0                                     | 15.0                                | 0.0     | 0.0                                                                                                                  | 15  |
|                                             | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 15                                                       |                                         | 2.0                                 |         | 8.0                                                                                                                  | 25  |
| Subject objectives                          | 1. Familiarizing students with the ways in which pollution from industry spreads in the environment,<br><br>2. Familiarizing students with the methods of purifying sewage, air and soil resulting from the impact of industry,<br><br>3. Developing the ability to independently conduct an experiment,<br><br>4. The ability to apply the methodology given in the instructions and interpret the obtained results,<br><br>5. The ability to present the results in writing. |                                                          |                                         |                                     |         |                                                                                                                      |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                               | Subject outcome                                                                                                      | Method of verification                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                 | [BCHINŻ_K02] Works individually demonstrating initiative and independence in actions, and effectively cooperates in a team, performing various roles in it.                                                                                                                                                                                                  | Student demonstrates creativity in independent and team work.                                                        | [SK8] observation of student's independent or team work |
|                                 | [BCHINŻ_W08] Enumerates and describes concepts and principles in the field of protection of industrial property and copyright and the use of patent information resources.                                                                                                                                                                                   | Student independently searches for information in the literature                                                     | [SW3] text preparation/written work                     |
|                                 | [BCHINŻ_K04] Demonstrates responsibility for the safety of her/his own and others' work.                                                                                                                                                                                                                                                                     | Student follows established research procedures                                                                      | [SK1] oral statement/conversation/discussion            |
|                                 | [BCHINŻ_U05] Evaluates the usefulness and functioning of existing engineering and technical solutions as well as research and measurement methods in the chemical industry.                                                                                                                                                                                  | Student presents correct technological reasoning in an understandable way, both orally and in writing.               | [SU5] implementation of a problem task                  |
|                                 | [BCHINŻ_U06] Proposes and makes simple devices, operations or unit processes related to the implementation of the technological process used in the chemical industry, taking into account material and energy balances.                                                                                                                                     | Student uses basic technological and chemical concepts describing environmental remediation technologies.            | [SU3] text preparation/written work                     |
|                                 | [BCHINŻ_W05] Describes the life cycle of devices, facilities and technical systems as well as modern environment-friendly technical solutions.                                                                                                                                                                                                               | Student lists and characterizes the basic technologies used for wastewater, water and air purification               | [SW4] test/exam - oral or written                       |
|                                 | [BCHINŻ_W01] Describes the relationship between the economy and the functioning of the chemical industry.                                                                                                                                                                                                                                                    | The student discusses the advantages and disadvantages of selected water, soil and sewage purification technologies. | [SW2] presentation/project/paper/report                 |
| Assessment methods and criteria | [BCHINŻ_U03] Plans, selects the appropriate research and measuring equipment and performs simple chemical experiments; analyses the results and draws conclusions based on them.                                                                                                                                                                             | Student predicts, verifies and critiques the results of conducted experiments                                        | [SU3] text preparation/written work                     |
|                                 | Carrying out exercises thematically related to the purification of soil, sewage, leachates and air. Removal of sulfur compounds from air and exhaust gases - study of sulfur dioxide absorption in a spray scrubber. Ozonation of an aqueous phenol solution. Removal of phosphorus and iron compounds. Soil purification using in-situ and ex-situ methods. |                                                                                                                      |                                                         |
|                                 | Basic knowledge of chemical technology                                                                                                                                                                                                                                                                                                                       |                                                                                                                      |                                                         |
|                                 | Basics of general chemistry                                                                                                                                                                                                                                                                                                                                  |                                                                                                                      |                                                         |
| Recommended reading             | Subject passing criteria                                                                                                                                                                                                                                                                                                                                     | Passing threshold                                                                                                    | Percentage of the final grade                           |
|                                 | Report                                                                                                                                                                                                                                                                                                                                                       | 51.0%                                                                                                                | 40.0%                                                   |
|                                 | Activity during classes - conducting experiments                                                                                                                                                                                                                                                                                                             | 51.0%                                                                                                                | 10.0%                                                   |
|                                 | Written test for each exercise                                                                                                                                                                                                                                                                                                                               | 51.0%                                                                                                                | 50.0%                                                   |
| Learning outcomes               | Basic literature                                                                                                                                                                                                                                                                                                                                             |                                                                                                                      |                                                         |
|                                 | Materials in the form of prepared laboratory instructions.                                                                                                                                                                                                                                                                                                   |                                                                                                                      |                                                         |

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|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>1. Głowiak B.: Fundamentals of environmental protection, PWN, Warsaw 1985.</p> <p>2. Koniecznyński J.: Waste gas purification, Silesian University of Technology, Gliwice 1990.</p> <p>3. Zaleska A., Zielińska-Jurek A., Soil remediation technologies, PG Publishing House, Gdańsk 2013.</p> <p>4. Kowalik P., Soil environment protection, PWN, Warsaw, 2001.</p> <p>5. Gworek B (ed.), Soil remediation technologies, Gabriel Borowski Scientific Publishing House, Warsaw 2004.</p> |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example issues/<br>example questions/<br>tasks being completed | <p>1. Explain what determines the choice of soil remediation technique? Describe thermal methods used for soil remediation.</p> <p>2. Explain how to reduce the emission of sulfur compounds into the atmosphere.</p> <p>3. List methods for reducing CO2 into the atmosphere. Explain what CO2 sequestration methods consist of.</p> <p>4. Propose a sequence of wastewater treatment processes (in the form of a block diagram) contaminated with: colloidal compounds, microorganisms, solid contaminants, and organic compounds.</p> <p>5. List and characterize water disinfection methods.</p> <p>6. Explain what advanced methods for pollutant oxidation consist of (list the methods used and characterize them).</p> <p>7. List and describe methods used for wastewater treatment.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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