

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                                                                                                                                        |                                     |         |                                                                                                                      |     |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Environmental engineering, PG_00103520                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                        |                                     |         |                                                                                                                      |     |
| Field of study                              | Environmental Protection                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |                                                                                                                                        |                                     |         |                                                                                                                      |     |
| Date of commencement of studies             | October 2026                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          | Academic year of realisation of subject                                                                                                |                                     |         | 2028/2029                                                                                                            |     |
| 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                               | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | Language of instruction                                                                                                                |                                     |         | Polish                                                                                                               |     |
| Semester of study                           | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | ECTS credits                                                                                                                           |                                     |         | 3.0                                                                                                                  |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          | Assessment form                                                                                                                        |                                     |         | exam                                                                                                                 |     |
| Conducting unit                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                                                                                                                                        |                                     |         |                                                                                                                      |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          | dr hab. inż. Ewelina Grabowska-Musiał                                                                                                  |                                     |         |                                                                                                                      |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |                                                                                                                                        |                                     |         |                                                                                                                      |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Lecture                                                  | Tutorial                                                                                                                               | Laboratory                          | Project | Seminar                                                                                                              | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30.0                                                     | 0.0                                                                                                                                    | 0.0                                 | 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                          | Introduce students with the basic technological processes used in water treatment<br>Introduce students with the basic processes of wastewater treatment and treatment of sewage sludge used in municipal wastewater treatment plants<br>and in industrial plants and the devices corresponding to these processes.<br>Acquiring basic knowledge about the types and sources of air pollution and the principles of operation of waste gas purifying devices |                                                          |                                                                                                                                        |                                     |         |                                                                                                                      |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          | Subject outcome                                                                                                                        |                                     |         | Method of verification                                                                                               |     |
|                                             | [OŚL3_W02] Characterises the relationships and relationships between various disciplines of natural sciences and science, uses knowledge of mathematics, physics, chemistry and biology in the description of basic concepts, concepts and principles in environmental protection.                                                                                                                                                                           |                                                          | explains the principles of selecting water, sewage and gas treatment technologies<br>waste depending on the type of pollutants removed |                                     |         | [SW4] test/exam - oral or written<br>[SW1] oral statement/<br>conversation/discussion                                |     |
|                                             | [OŚL3_W11] Discusses measurement systems and analysis techniques used in monitoring the state of the natural environment.                                                                                                                                                                                                                                                                                                                                    |                                                          | characterizes the methods and explains the operation of devices used in treatment water, wastewater and waste gas treatment            |                                     |         | [SW1] oral statement/<br>conversation/discussion                                                                     |     |
|                                             | [OŚL3_K06] Knows and appreciates the practical application of the acquired knowledge and skills in solving problems.                                                                                                                                                                                                                                                                                                                                         |                                                          | explains the processes occurring in various elements of the environment after introduction of contaminants into them;                  |                                     |         | [SK5] implementation of a problem task                                                                               |     |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Subject contents                | Lecture issues<br>Principles of green chemistry and green engineering. Types and sources of water, soil and air pollution. Water parameters. Municipal and industrial wastewater treatment technologies. Sewage sludge management methods. Classification of soil remediation methods. Physico-chemical methods of soil reclamation. Thermal methods of soil remediation. Air dedusting methods. Dry dedusting. Wet dedusting. Odor control. NOx control. NOx removal from flue gases. Flue gas desulphurization. Air protection by desulfurization of fossil fuels. CO2 emission control. Photocatalytic methods of air purification. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |
| Prerequisites and co-requisites | Prerequisites describing the course of natural and anthropopressory physical, chemical and biological processes occurring in the natural environment; application of basic methods and techniques of work in a chemical laboratory; defining and searching for applicable legal regulations and instruments of applying the law in environmental protection                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Percentage of the final grade |
|                                 | exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 100.0%                        |
| Recommended reading             | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Grabowska-Musiał Ewelina., unpublished materials, made available to students during classes<br><br>1. Instructions for auditorium-laboratory exercises<br>2. Hermanowicz I., Dojlido J., Fizyczno-chemiczne badania wody i ścieków, Arkady, Warszawa 1999<br>3. A.L. Kowal, M. Świdorska-Bróż, Oczyszczanie wody, Wydawnictwo Naukowe PWN, Warszawa 2009<br>4. Dymaczewski Z. (red), Poradnik eksploatatora oczyszczalni ścieków, PZliTS, Poznań 2011<br>5. Bartkiewicz B., Oczyszczanie ścieków przemysłowych, Wydawnictwo Naukowe PWN, Warszawa 2007<br>6. Jędrzak A., Biologiczne przetwarzanie odpadów, Wydawnictwo Naukowe PWN, Warszawa 2007<br>7. Imhoff K., Kanalizacja miast i oczyszczanie ścieków, Projprzem-EKO, Bydgoszcz 1996<br>8. Warych J., Oczyszczanie przemysłowych gazów odlotowych, WNT Warszawa 1994<br>Extracurricular readings |                               |
|                                 | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | brak                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |
|                                 | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |

Example issues/  
example questions/  
tasks being completed

Explain the concept of sustainable development

Briefly discuss three environmental protection strategies

Using a selected example, discuss the circulation of pollutants in the environment

List and briefly discuss the main sources of atmospheric pollution

List and briefly discuss methods for reducing sulfur emissions into the atmosphere

Discuss in detail three selected methods of removing sulfur from solid fuels

Draw a diagram of the installation and, based on it, discuss the Claus process of desulfurization of crude oil and petroleum products

Draw a diagram of the installation and, based on it, discuss the process of hydrodesulfurization of crude oil and petroleum products

List and briefly discuss the methods of flue gas desulfurization

Draw a diagram of the installation and, based on the drawing, discuss the principle of coal desulfurization using the difference in the density of coal and pyrite

Discuss the lime-lime method as an example of the wet method used for flue gas desulfurization

List and briefly discuss methods of reducing CO<sub>2</sub> emissions into the atmosphere

List and briefly discuss the methods of separating CO<sub>2</sub> from exhaust gases

List and briefly discuss the methods of geological CO<sub>2</sub> storage

What determines the choice of water treatment technology?

List the main groups of contaminants found in water and methods of removing them

Describe the characteristics of slow and fast filters. Explain what it is and how it works.

Discuss one selected method for removing hardness from water

Discuss the method of iron removal/demanganization of water

Discuss the coagulation process (type of impurities removed during coagulation, mechanism, coagulants used)

Discuss the method and devices used to remove suspensions with a density greater than that of water

Discuss the method and devices used to remove suspensions with a density lower than that of water

Draw and discuss the principle of operation of a lamella settler

Discuss the role of activated carbon in sorption processes

What is the primary disinfection process? What parameters influence the course and effectiveness of this process? Briefly discuss other processes.

Discuss the flotation process used in water purification processes

Discuss the ion exchange process used in water purification processes. What are the stages of this process and what parameters affect its effectiveness.

Explain the differences between the composition of municipal and industrial wastewater

What is the purpose of wastewater treatment? Classification of sewage treatment plants

Discuss the mechanical methods used to treat wastewater

Discuss biological methods used to treat wastewater

Describe the principle of operation of an SBR reactor

What are biological deposits? When do we use them? What are their advantages and disadvantages?

Explain the difference between activated sludge and biological deposits.

Discuss one selected method of advanced oxidation of pollutants. Where do we use AOP methods?

What are sewage sludges and how are they formed? Discuss the chemical composition of sewage sludge

Briefly discuss the properties of sewage sludge

List and briefly discuss the methods of sewage sludge management in Poland

How to reduce the volume of sewage sludge. Briefly discuss known methods.

Discuss the equipment used for drying sewage sludge

Discuss the process of composting sewage sludge

Explain what the process of sewage sludge hygienization is. List and discuss the methods used for sludge hygienization.

Explain the process of stabilizing sewage sludge. List and discuss the methods used to stabilize sediments.

Discuss the process of sewage sludge incineration

Explain the process of dephosphatation, nitrification and denitrification.

Discuss the classification of soil remediation methods. What determines the choice of remediation method for contaminated soil?

List and critically discuss physicochemical methods of soil reclamation used in-situ

Draw an example diagram of an installation for soil cleaning using the vacuum method in in-situ conditions and discuss the process on this basis.

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|                | <p>Draw an example diagram of an installation for soil purification using the chemical oxidation method in in-situ conditions and discuss the process on this basis.</p> <p>Discuss the process of recovering precious metals from waste</p> <p>Characterize municipal waste</p> <p>What are the requirements for modern waste landfills?</p> <p>What determines the choice of location for a waste landfill?</p> |
| Work placement | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                    |

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