COURSE DESCRIPTION CARD - SYLLABUS

Course name
Anthropogenic disturbance of the hydrosphere [S2TOZ1>AZwFH]

Course

Field of study
Circular System Technologies

Year/Semester
1/2

Area of study (specialization)
Material recycling and chemical recovery

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student has a foundation in chemistry from bachelor of engineering studies. Uses basic laboratory equipment and applies health and safety rules correctly. He/she has the ability to work in a group and to make reports from laboratory exercises. He/she has a positive attitude towards deepening his/her knowledge, and at the same time is sensitive to environmental problems and minimising pollution with chemical substances.

Course objective

To acquire knowledge of the basic ways in which anthropogenic pollution streams spread in the aquatic environment, the types of hazards arising from this and the ways in which they negatively affect the natural environment. To deepen practical skills related to working in a chemical laboratory together with the application of appropriate safety rules. Determination of selected water quality indicators and practical learning about selected processes related to water protection.

Course-related learning outcomes

Knowledge:
Has advanced, structured and theoretically underpinned knowledge of the principles of the circular economy and the reasons why it is implemented. K_W02
Has structured, advanced knowledge to recognise, assess the harmfulness and neutralise factors hazardous to the environment. K_W04
Has extended knowledge to recognise and differentiate factors hazardous to the environment and knows the principles of waste neutralisation and recovery taking into account the requirements of a circular economy. K_W06
Has a structured knowledge of sampling, storage of samples and proper selection of analytical techniques for their analysis. K_W10

Skills:
Has an ease of verbal communication with professionals in the area of the circular economy and related fields. K_U01
Is able to plan, prepare and present a presentation on the implementation of a research task and conduct a substantive discussion on a given topic. K_U02
He/she has the skills to use the knowledge possessed to identify and select methods of disposal/management of various industrial wastes, taking into account the principles of the circular economy, and to propose improvements to existing technological solutions, taking into account legal acts in force. K_U03
Possesses the ability to selectively adapt knowledge of chemistry and related fields in the planning and implementation of research and technological tasks in the field of technologies based on a circular economy, and to analyse their impact on the environment. K_U08
Is able to skilfully use professional literature and expert opinion, integrate obtained information, interpret and critically evaluate it, and formulate competent opinions and reports on this basis. K_U15
Can analyse and critically evaluate new areas in circular system technologies and related fields, assess their innovativeness and technical feasibility. K_U16

Social competences:
He/she is aware of personal responsibility resulting from his/her professional role and of the emergence of moral and ethical problems in the context of professional activities. K_K01
Understands the need to popularise knowledge on sustainable production and technological solutions in a circular economy. K_K02
Critically evaluates his/her knowledge, understands the need for further education and improving his/her professional, personal and social competences. K_K03
He/she is able to think and act in an entrepreneurial manner, while being aware of his/her social role and public interest. K_K04

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: the final verification of learning outcomes takes place in the form of a final test. In the course of lectures, students may also gain additional points for activity and ability to interpret presented issues.
Laboratory: the lecturer of laboratory classes controls the theoretical preparation of students to perform the planned exercises. The control takes place through questioning in the form of written tests. The teacher observes and evaluates the students' behaviour in the laboratory, including the ability to organise the laboratory work and manual skills while performing the planned exercises. Written reports of the performed exercises are evaluated assessing the way they are described and interpreted. The final mark for laboratory classes is the resultant of the above mentioned component marks.

Programme content

Types of threats in the hydrosphere caused by civilisation development. Assessment of the state of water. Ways to reduce the impact of pollution on the aquatic environment in relation to the concept of a circular economy, which aims to optimise the use of materials and raw materials by reducing the amount of waste produced.

Course topics

Lecture:

Properties of water and concepts of its origin on Earth. Characteristics of water. Pollution and degradation of water. Monitoring of water quality. Indicators of water quality (physical, chemical and biological). Types of water in soil. Soil pollution criteria related to the chemisation of agriculture. Definition of sustainable water management. Relevance in the context of climate change and increasing population. Contaminants of the hydrosphere: municipal and industrial waste, heavy metals, polycyclic aromatic hydrocarbons, dioxins, pesticides, surfactants and others. Biological and non-biological processes applicable to water treatment and purification (infiltration, neutralisation, coagulation, flocculation, sedimentation, filtration, adsorption, disinfection, cavitation). Selected water treatment technologies. Construction and operation of a typical water treatment plant. Water restoration. Trends in the development of modern water treatment systems. Self-purification processes of water. Revitalization of water reservoirs. River and lake restoration techniques. Natural water purification systems. The role of wetlands and buffer zones in water purification. Biofilters and plant-based systems. Methods of minimising water use in industry and agriculture. Water recovery and reuse technologies. Urban water resource management. Green roofs and walls as water retention elements. Rainwater harvesting systems.Ecological solutions for agricultural land. Sustainable agriculture and water management. Environmentally friendly irrigation systems. Protection of aquatic ecosystems. Strategies for biodiversity conservation.
Laboratory:
Decarbonisation of water. Coagulation in water treatment. Sorption methods in water restoration. Removal of Fe and Mn. Determination of selected water quality indicators (turbidity, oxidisability, colour, redox potential, conductivity, surfactant content, oxygen concentration, COD, BOD5, ... etc.). Selected cuvette tests.
Assessment of surface water quality using field analytical kits.
Titration, spectrophotometric and precipitation methods will be used to analyse basic water quality parameters before and after treatment.

Teaching methods

Lecture: is based on interactive multimedia presentations containing relevant practical examples with explanations based on students' current interests. The possibility of discussion during the lecture reduces monotony and increases the quality and attractiveness of the classes.
Laboratory: according to the attached instructions, students independently perform the exercises included in the course plan. The instructor controls the students' behaviour in the laboratory and the way in which they perform individual tasks. He draws attention to faults and corrects them. Students are required to keep notes, on the basis of which they prepare reports on the laboratory exercises performed.

Bibliography

Basic:
1. J. Wójcik, Antropogeniczne zmiany środowiska przyrodniczego ziemi, PWN, Warszawa 2020
2. A.M. Anielak, Wysokoefektywne metody oczyszczania wody, PWN, Warszawa 2016
3. A.L. Kowal, M. Świderska-Bróż, M. Wolska, Oczyszczanie wody, t.1-2, PWN, Warszawa 2023
4. T. Szklarczyk, M. Stach-Kalarus, E. Kmiecik, Wybrane metody i narzędzia badawcze w bilansowaniu wodnogospodarczym i ocenia stanu wód podziemnych, AGH, Kraków 2011
5. J. Marciniak-Kowalska, Chemia wybranych komponentów środowiska, AGH, Kraków 2016
6. K. Lipkowska-Grabowska, E. Faron-Lewandowska, Pracownia chemiczna analiza wody i ścieków, Wydawnictwo szkolne i pedagogiczne, Warszawa 1998

Additional:
1. J. Minczewski, Z. Marczenko, Chemia analityczna, t.1-2, PWN, Warszawa 2012
2. J. Naumczyk, Chemia środowiska, PWN, Warszawa 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00