

SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University of Cluj-Napoca
1.2 Faculty	Environmental Science and Engineering
1.3 Department	Environmental Analysis and Assessment
1.4 Field of study	Environmental Engineering
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Environmental Engineering

2. Date despre disciplină

2.1 Name of the discipline	Chemistry 2						
2.2 Course coordinator	Conf. Dr.Habil. Beldean-Galea Mihail-Simion						
2.3 Seminar coordinator	Conf. Dr.Habil. Beldean-Galea Mihail-Simion						
2.4 Year of study	I	2.5 Semester	II	2.6. Type of evaluation	Ex	2.7 Type of discipline	Obl.

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					6
Evaluations					4
Other activities:					0
3.7 Total individual study hours	70				
3.8 Total hours per semester	126				
3.9 Number of ECTS credits	5				

4. Prerequisites (if necessary)

4.1 curriculum	Inorganic and organic chemistry courses in middle and high school.
4.2 competencies	- Cognitive skills: possession of basic notions in the fields of inorganic and organic chemistry. - Action skills: information and documentation, group work, argumentation and use of information technologies for acquisition + processing of analytical data; carrying out active and critical analyses; operationalization and application of knowledge.

5. Conditions (if necessary)

5.1 for the course	• Video projector, blackboard, white and colored chalk.
5.2 for the seminar /lab activities	• Environmental chemistry laboratory equipped with water, gas, niche and common laboratory glassware. Safety glasses, gloves, lab coat.

6. Specific competencies acquired

Professional competencies	• Knowledge of the sources of environmental pollution and the types of pollutants that affect the quality of the environment. • Understanding the main chemical reactions that exist in the environment. • Understanding the processes of transformation of pollutants in the environment and useful aspects in environmental protection. • Understanding the chemical processes that control/affect the distribution and transfer of pollutants into environment. • Understanding the local and regional effects that pollutants emitted into the environment can generate.
Transversal competencies	• Competencies regarding the understanding of the main toxicological effects that pollutants and the processes in which they are involved can affect the health of biota. • Competencies regarding the understanding of the influence of environmental conditions on the behavior of chemical species present in the respective environment. • Development of action skills: information and documentation, group work, argumentation and use of information technologies for acquisition + processing of analytical data. • Competencies to reflect – individually and collectively – on various issues, topics, problems.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Acquisition of theoretical and practical concepts related to the main chemical processes that control/affect the distribution and transfer of pollutants in the environment.
7.2 Specific objective of the discipline	• Knowledge of the sources of environmental pollution, the types of pollutants as well as the processes and reactions in which they are involved. • Description of the main processes of pollutants transformation in the environment, correlated with useful aspects in environmental protection. • Description of the local and regional effects that pollutants emitted into the environment can generate.

8. Content

8.1 Course	Teaching methods	Remarks
1. Definitions: contamination and chemical pollution, qualitative and quantitative components of the environment. Basic properties of organic and inorganic pollutants. 2. Chemistry of the atmosphere. Classification of air pollutants. Primary and secondary air pollutants. Scheme of formation of secondary pollutants. 3. Chemical processes in the atmosphere. Photolysis, radical, oxidation and acid-base reactions. Transport and transfer of pollutants in the atmosphere. 4. Inorganic air pollutants. Organic air pollutants. Methane and non-methane compounds. Air quality index. 5. Effects of air pollution. Acid rain. Chemical and photochemical smog. Formation of tropospheric ozone. Depletion of the ozone layer. Climate changes. 6. Chemistry of the hydrosphere. Chemical composition of water. General water quality parameters. Hydrogen ion indicators; pH and salt hydrolysis, acidity, alkalinity, redox potential. 7. General water quality parameters: indicators of common ions (total dissolved solids, conductivity, hardness, salinity); indicators of the oxygen (DO, COD-Cr, COD-Mn, BOD5, TOC) 8. Inorganic water pollutants. Heavy metals. Nitrogen compounds. Phosphorus compounds. 9. Organic water pollutants. Persistent organic pollutants. PAH, Dioxins, PCB, THM, Pesticides. 10. Chemical and biochemical processes in the hydrosphere. Transport and transfer of pollutants in aquatic environments. 11. Effects of water pollution. Eutrophication. Hypoxia. Ocean acidification. Water quality index 12. Soil chemistry. Chemical and biochemical processes in soil. Soil pollutants. 13. Humic substances. Biodegradation, bioaccumulation and biomagnification of pollutants. 14. Biogeochemical cycles.	Interactive Lecture Exposition Problem-Based Learning Problematization Exercises and Problem Solving Case Study Presentation Heuristic Conversation Explanation Modeling	Attendance at the course is optional, but recommended. Attendance at practical activities and seminars is mandatory. The number of absences accepted in special situations is a maximum of 20% of the total number of hours. Students who are absent from the seminar / laboratory cannot appear for the exam. The individual project is handed to the course instructor before the exam. Plagiarism involves the cancellation of the work developed by the student. Cases of exam fraud involve: automatic exclusion from the exam, awarding a grade of 1 and the proposal to expel the student in question.
Bibliography: 1. Haiduc Iovanca; Boboș L. „<i>Chimia mediului și poluanții chimici</i>”, Editura Fundației pentru Studii Europene (EFES), Cluj-Napoca, 2005. 2. Lupea A. X. et al.. <i>Fundamente de chimia mediului</i>, Editura Didactică și Pedagogică, București, 2008. 3. Manahan S.E., „<i>Environmental Chemistry – Eight Edition</i>”, CRC Press, USA, 2004. 4. Ibanez J.G., <i>Environmental Chemistry. Fundamentals</i>, eISBN-13:978-0-387-31435-8, 2007 Springer Science		

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Labor protection rules in chemistry laboratories. Presentation of laboratory glassware and how to handle it.	Conversation	Seminar
2. Basic properties of chemical pollutants. Oxidation, Reduction, Neutralization, Precipitation, Complexation	Demonstrative experiment	Laboratory
3. Primary pollutants. Secondary pollutants. Instrumental determination of CO, NO _x , SO ₂ , O ₃ . Calculation of the air quality index (AQI)	Demonstrative experiment	Laboratory
4. CO ₂ cycle. Study of the diurnal variation of CO ₂ .	Demonstrative experiment	Laboratory
5. Global effects of air pollution	Conversation	Seminar
6. Chemical processes in water. Hydrolysis of salts. Determination of pH, acidity and alkalinity of water.	Demonstrative experiment	Laboratory
7. Chemical composition of water. Identification of anions	Demonstrative experiment	Laboratory
8. Chemical composition of water. Identification of cations	Demonstrative experiment	Laboratory
9. Water quality. Indicators of common ions. Determination of conductivity, total dissolved solids, hardness, salinity	Demonstrative experiment	Laboratory
10. Water quality. Oxygen regime indicators. Dissolved oxygen determination. COD-Mn determination.	Demonstrative experiment	Laboratory
11. Biogenic indicators. Hypoxia. Eutrophication. Water quality index	Conversation	Seminar
12. Chemical and biochemical processes in soil	Conversation	Seminar
13. Analysis of soil samples. Determination of sulfates.	Demonstrative experiment	Laboratory
14. Laboratory colloquium.		Written examination
Bibliography: 1. Mănescu S. et al.. – „ <i>Chimia sanitară a mediului</i> ”, Editura Medicală, București, 1978. 2. Roșu C. – „ <i>Bazele chimiei mediului: Îndrumător de lucrări practice de laborator</i> ”, Editura Casa Cărții de Știință, Cluj-Napoca, 2007. 3. Beldean-Galea M.S. – „ <i>Analiza probelor de mediu. Teorie și aplicații practice</i> ” Ed. Casa Cărții de Știință, Cluj-Napoca, 2016		

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The content of the discipline is in agreement with the expectations of the representatives of the epistemic community, professional associations and representative employers in the field of Environmental Science, as it presents a series of concepts related to pollution with various inorganic and organic pollutants, their behavior in various environmental factors, as well as a series of ecotoxicological aspects (adverse effects of chemical pollutants on terrestrial ecosystems). For this purpose, both simple terms are used (necessary as a starting point and from a terminological point of view), as well as somewhat more advanced mathematical reasoning and models (useful for deepening and understanding the details).
- The course presents several calculation examples and exercises with the aim of familiarizing the audience with a series of quantitative assessments and with the order of magnitude of the exchanges involved, particularly necessary for a good training in the field of environmental science. For increased accessibility, numerous figures, tables and images are used, which facilitate a good understanding of the impact of chemical pollutants on various environmental factors.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.1 Course	Assessment of theoretical knowledge acquired	Exam	60%
	Course activity	Correctness of answers given to the lecturer's questions	5%
10.2 Seminar/lab activities	Seminar/laboratory activity	Quality of answers to questions and experimental results	15%
	Assessment of knowledge acquired	Laboratory colloquium	20
10.3 Minimum performance standards			
• Minimum grade 6 in Seminar/Lab • Minimum grade 5 in Course.			

Date

Signature of course coordinator

Signature of seminar coordinator

04.12.2024

Date of approval

Signature of the head of department
