SYLLABUS

1. Information regarding the programme

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

2. Information regarding the discipline

2.1 Name of the discipline	**Chemistry III**						
2.2 Course coordinator			Assist. Prof. Dr. Roba Carmen				
2.3 Seminar coordinator			Assist. Prof. Dr. Roba Carmen				
2.4 Year of study	II	2.5 Sem.	3	2.6. Type of assessment	C	2.7 Type of discipline	DF

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					26
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					-
Evaluations					4
Other activities:					

3.7 Total individual study hours	70
3.8 Total hours per semester	126
3.9 Number of credits	5

4. Prerequisites (if necessary)

4.1 Curriculum	• Not the case
4.2 Competences	• Not the case

5. Conditions (where applicable)

5.1. for the course	• Normal (classic) conditions of attendance at teaching activities
5.2. for the seminar /lab activities	• Mandatory attendance during practical activities • Students will wear a robe in the laboratory • The delivery of the laboratory report will be made no later than the week following the actual development of the work

6. Specific competencies acquired

Professional competencies	- Applying basic technical and technological knowledge in defining and explaining concepts specific to engineering and environmental protection - Description and application of concepts, theories, and practical/technological/engineering methods for determining the state of environmental quality - Qualitative and quantitative evaluation of natural phenomena and anthropogenic activities on the quality of environmental factors - Explaining and interpreting basic concepts, methods, and models in environmental engineering issues - Identification of the best technical and technological solutions for the implementation of professional engineering and environmental protection projects
Transversal competencies	- Identifying and complying with the rules of ethics and professional deontology, assuming responsibility for the decisions taken and the related risks - Identifying roles and responsibilities in a multidisciplinary team and applying relationship techniques and effective work within the team - Efficient use of information sources and resources for communication and assisted professional training (portals, Internet, specialized software applications, databases, online courses, etc.) both in Romanian and in an international language - Description, analysis, and use of concepts and theories in the fundamental scientific fields (mathematics, physics, chemistry) and in the field of engineering sciences - Description, analysis and use of concepts and theories in the economic-managerial field applied in the field of environment

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

7.1 General objective of the discipline	• Knowledge and understanding of the important role of green chemistry and engineering in sustainable development and the achievement of a sustainable human society
7.2 Specific objectives	• Understanding the concept of green chemistry: environmentally friendly chemistry, i.e. the design, creation, and application of chemical products and processes to reduce/eliminate the use and generation of hazardous substances. • understanding the content of green chemistry (environmentally benign syntheses, pharmaceuticals, green solvents, and bio-based processes) and comparing it with the current state of the environment and the level of hazardous substances present in it

8. Contents

8.1 Course	Teaching methods	Remarks
8.1.1. Description of the current state and potential of chemical synthesis to use and generate as few hazardous substances as possible	lecture, explanation, conversation	2 hours
8.1.2. *Principle 1*: Prevention of waste formation; *Principle 2*: Economy of atoms	lecture, explanation, conversation	2 hours
8.1.3. *Principle 3*: Less hazardous chemical syntheses; *Principle 4*: Reduce toxicity, achieve safer chemicals	lecture, explanation, conversation	2 hours
8.1.4. *Principle 5*: Safer solvents and auxiliary materials; *Principle 6*: Reducing energy needs	lecture, explanation, conversation	2 hours
8.1.5. *Principle 7:* Use of renewable raw materials; *Principle 8*: Avoid derivatization	lecture, explanation, conversation	2 hours
8.1.6. *Principle 9*: Use of catalysts; *Principle 10*: Accident prevention	lecture, explanation, conversation	2 hours
8.1.7. Biomass and biogas as renewable resources	lecture, explanation, conversation	2 hours
8.1.8. Ethanol used as fuel	lecture, explanation, conversation	2 hours
8.1.9. Biodiesel	lecture, explanation, conversation	2 hours
8.1.10. Hydrogen, a basic fuel	lecture, explanation, conversation	2 hours
8.1.11. Solar energy	lecture, explanation, conversation	2 hours
8.1.12. Wind energy resources	lecture, explanation, conversation	2 hours
8.1.13. Energy of the seas and oceans, hydroelectric resources, geothermal energy resources	lecture, explanation, conversation	2 hours
8.1.14. Catalysis and Green Chemistry	lecture, explanation, conversation	2 hours

Bibliography

1. Course material.
2. M.S. Beldean-Galea, I. Haiduc, C.A. Roba, Chimia verde. Principii şi aplicabilitate, Presa Universitară Clujeană, 2013.
3. F. M. Kerton, Alternative Solvents for Green Chemistry, 2009, în RSC Green Chemistry Book Series, Editori J. H Clark, G. A Kraus.
4. I. Haiduc, Chimia verde şi poluanţii chimici, Editura EFES Cluj-Napoca, 2006.
5. E. Lichtfouse, J. Schwarzbauer, D. Robert, *Green Chemistry and Pollutants în Ecosystems*, Springer Veslag, 2005.

8.2 Seminar/Laboratory	Teaching methods	Remarks
8.2.1. Applications of 'green' methods in the treatment of metal ion-containing wastewater by ion exchange	experiment, conversation, learning through discovery	4 hours / 2 weeks
8.2.2. 'Green' method for removing ammonium ions from wastewater using natural materials	experiment, conversation, learning through discovery	4 hours / 2 weeks

8.2.3. Solid-phase extraction - a "green" method of isolating and concentrating azo compounds from water	experiment, conversation, learning through discovery	4 hours / 2 weeks
8.2.4. Determination of 'green' substances using gas chromatography	experiment, conversation, learning through discovery	4 hours / 2 weeks
8.2.5. Atom economy	experiment, conversation, learning through discovery	4 hours / 2 weeks
8.2.6. Environmental factor	experiment, conversation, learning through discovery	4 hours / 2 weeks
8.2.7. Green chemical syntheses	experiment, conversation, learning through discovery	4 hours / 2 weeks
Bibliography 1. Laboratory reports. 2. M.S. Beldean-Galea, I. Haiduc, C.A. Roba, Chimia verde. Principii şi aplicabilitate, Presa Universitară Clujeană, 2013. 3. I. Haiduc, Chimia verde şi poluanţii chimici, Editura EFES Cluj-Napoca, 2006.		

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

- Use of appropriate analysis methods to characterize environmental factors - Introduction of the best available investigation methods in environmental engineering projects

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight of the final grade
10.4 Course	Correctness of answers – correct acquisition and understanding of the issues dealt with in the course	Written exam - access to the exam is conditioned by the laboratory colloquium and the presentation of laboratory reports corresponding to all practical papers	80 %
10.5 Laboratory	Correctness of answers – correct acquisition and understanding of the aspects addressed in the laboratory	Laboratory reports corresponding to all practical works	20 %

	Quality of the prepared reports	Colloquium – test – is held in the last week of teaching activity	
10.6 Minimum Performance Standard			
- Grade 5 (five) both at the laboratory colloquium and at the written colloquium according to the scale - understanding the concept of green chemistry - environmentally friendly chemistry - i.e. designing, creating, and applying chemical products and processes to reduce/eliminate the use and generation of hazardous substances. - understanding the content of green chemistry (environmentally benign syntheses, pharmaceuticals, green solvents, and bio-based processes) and comparing it with the current state of the environment and the level of hazardous substances present in it.			

Date of approval	Signature of the course holder	Signature of the seminar holder
04.12.2024	Lecturer Dr. Roba Carmen	Lecturer Dr. Roba Carmen

Date of approval in the department	Signature of the department director
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