COURSE SYLLABUS

1. Program Information

1.1 Higher Education Institution	Babeş-Bolyai University, Cluj-Napoca
1.2 Faculty	Environmental Science and Engineering
1.3 Department	Environmental Analysis and Engineering
1.4 Field of Study	Environmental Engineering
1.5 Study Cycle	Bachelor's Degree
1.6 Study Program / Qualification	Environmental Engineering Environmental Engineer

2. Course Information

2.1 Course Name	**Integrated pollution prevention and control**						
2.2 Course Instructor	Radovici Andrei						
2.3 Seminar Instructor	Radovici Andrei						
2.4 Study Year	IV	2.5 Semester	8	2.6. Assessment Type	Ex.	2.7 Course Status	Obligatory

3. Total Estimated Time (hours per semester for teaching activities)

3.1 Number of hours per week	4	Of which: 3.2 lecture	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 lecture	28	3.6 seminar/laboratory	28
Time Allocation:					ore
Study from the textbook, course materials, bibliography, and notes					30
Additional research in the library, on specialized electronic platforms, and in the field					40
Preparation for seminars/laboratories, assignments, papers, portfolios, and essays					40
Tutoring					12
Exam					4
Other:					0

3.7 Total hours of independent study	126
3.8 Total hours per semester	182
3.9 Credits	7

4. Prerequisites (where applicable)

4.1 Curriculum prerequisites	• Chemistry I, Chemistry II or Environmental Chemistry.
4.2 Skill prerequisites	• Basic notions of environmental chemistry, information and documentation, teamwork, use of information technologies for data acquisition and their processing

5. Conditions (where applicable)

5.1 for conducting the lecture	• Classroom with video projector
5.2 for conducting the seminar/laboratory	• Seminar room and laboratory with computers

6. Specific skills acquired

Professional skills	• Analysis and evaluation of industrial processes in order to identify and minimize sources of pollution, using fundamental models and theories from environmental sciences and engineering. • Application of environmentally friendly methods and technologies for the prevention and reduction of negative environmental impact in industrial activities, based on concepts from basic sciences and engineering. • Interpreting and explaining the principles of sustainable development and integrating them into the management and planning of industrial processes, in order to reduce pollution. • Developing and presenting projects and practical solutions for pollution prevention, using interdisciplinary knowledge from environmental sciences and engineering. • Recognition and use of environmental norms, regulations and standards in the context of pollution prevention in industry, including clean technologies and good practices.
Transversal skills	• Assuming professional and ethical responsibilities in the pollution prevention activity, respecting the deontological norms and assessing the impact of the decisions taken on the environment and society. • Effective collaboration in interdisciplinary teams, using communication, networking and coordination techniques for the implementation of pollution prevention solutions in the industry. • Search and use of digital and informational resources (databases, software applications, online courses) for the continuous updating of knowledge in the field of pollution prevention, in Romanian and international languages. • Integration of economic-managerial concepts in the design and implementation of sustainable industrial solutions, evaluating the costs and benefits associated with environmental protection. • Developing a global and strategic perspective on environmental issues, through the use of modern communication technologies and active participation in international and multidisciplinary initiatives.

7. Course Objectives (derived from the competencies acquired)

7.1 General Objective	Evaluation and application of technological and organizational solutions for the prevention, reduction and management of pollution in industrial processes, in accordance with the principles of sustainable development and environmental regulations.
7.2 Specific Objectives	• Promoting understanding of the impact of industrial processes on the environment. • Developing the capacity to design and implement green technologies and sustainable industrial processes. • Encouraging an integrated approach to environmental issues, including economic, technical and social perspectives. • Stimulating a proactive mindset in the application of environmental norms and standards. • Preparation for interdisciplinary collaboration and adaptation to the requirements of the labor market in the field of environmental protection.

8. Content

8.1 Course	Teaching methods	Observations
C 1 – Introduction to Pollution PreventionPrinciples, basic concepts and the importance of pollution prevention in an industrial context.	Interactive lecture	
C 2 – Sources and types of industrial pollution Air, water, soil pollution and waste generation; impact on the environment and health.	Presentation / Problematization / Presentation of case studies	
C 3 – Basics of environmental permitting (Environmental Permit, Environmental Agreement, Environmental Permit) – Law 278/2013 on Industrial Emissions.	Presentation / Problematization / Presentation of case studies	
C 4 – Obligations of the economic operator Categories of activities of the economic operator.	Presentation / Problematization / Presentation of case studies	
C 5 – List of pollutants Emission limit values (VLE), parameters and equivalent technical measures. Monitoring requirements.	Presentation / Problematization / Presentation of case studies	
C 6 – Environmental risk assessment and management Methods for identifying, assessing and minimising risks associated with industrial activities.	Presentation / Problematization / Presentation of case studies	
C 7 – Clean and eco-efficient technologies Innovative processes and technologies for pollution reduction and prevention.	Presentation / Problematization / Presentation of case studies	
C 8 – Modifications to installations by the economic operator Review and update of authorisation conditions. Environmental inspection. Criteria for determining the best available techniques (BATs).	Presentation / Problematization / Presentation of case studies	
C 9 – Prevention of industrial pollution Reduction, reuse, recycling, recovery or disposal (circular economy principles).	Presentation / Problematization / Presentation of case studies	
C 10 – Sustainable planning in industry Development of industrial plans and projects in accordance with the principles of sustainable development.	Presentation / Problematization / Presentation of case studies	
C 11 – Access to information and public participation Public participation in the authorisation procedure/decision-making.	Presentation / Problematization / Presentation of case studies	
C 12 – **Challenges and opportunities in the implementation of green technologies in industry** Exploring economic, technological and legislative barriers to the adoption of green solutions, as well as the long-term benefits for the environment and society.	Presentation / Problematization / Presentation of case studies	

References

- Alexandru Ozunu,Carmen Teodosiu ,, Prevenirea poluarii mediului,, Ed.Univ.Transilvania, Brasov, 2002
- Florin Ardelean, Vasile Iordache, ,,Ecologie si protectia mediului,,, Ed. MatrixRom, Bucuresti, 2007
- Legea 278 / 2013 privind emisiile industriale
- Radovici, Andrei, Horațiu Ștefănie, Iulia Ajtai, Alexandru Mereuță, Camelia Botezan, Alexandru Ozunu, and Nicolae Ajtai. 2023. "Is the Analysis of Territorial Compatibility in the Vicinity of Road Hazmat Transport Routes a Necessity for Developing Countries? A Case Study of Romania." Heliyon 9 (9): e19948. https://doi.org/10.1016/j.heliyon.2023.e19948
- Botezan, Camelia, Veronica Constantin, Monika Meltzer, Andrei Radovici, Alina Pop, Filip Alexandrescu, and Lucrina Stefanescu. 2020. "Is There Sustainable Development after Mining? A Case Study of Three Mining Areas in the Apuseni Region (Romania)." Sustainability 12 (23): 9791. https://doi.org/10.3390/su12239791.
- Török, Z., A. Ozunu, A. Radovici, C. Maloș, A. Calapod, and F. Senzaconi. 2021. "Natech Hazard Identification at National Level for Seveso Sites Affected by Floods and Earthquakes." Studia Universitatis Babes-Bolyai Chemia 66 (2): 255–64. https://doi.org/10.24193/subbchem.2021.2.22
- Botezan, Camelia S, Andrei Radovici, and Iulia Ajtai. 2022. "The Challenge of Social Vulnerability Assessment in the Context of Land Use Changes for Sustainable Urban Planning; Case Studies: Developing Cities in Romania." Land 11 (1). https://doi.org/10.3390/land11010017
- Freeman, Harry, Teresa Harten, Johnny Springer, Paul Randall, Mary Ann Curran, and Kenneth Stone. "Industrial pollution prevention! A critical review." Journal of the Air & Waste Management Association 42, no. 5 (1992): 618-656.
- Shen, Thomas T. "Industrial pollution prevention." In Industrial pollution prevention, pp. 15-35. Berlin, Heidelberg: Springer Berlin Heidelberg, 1999.

8.2 Seminar / laborator	Teaching methods	Observations
S 1 – Organization of seminar teaching activities- Overview of the topics of courses and seminars, setting objectives and evaluation methods.	Conversation / Exposure	Attendance at seminar activities is MANDATORY, in proportion of 80%.
S 2 – Sources of pollution and categories of industrial emissions- Identification of the main sources of pollution from different industries (air, water, soil) and analysis of specific emission types. Discussions based on industry case studies.	Presentation / Problematization / Presentation of case studies	
S 3 – Environmental permit procedure: Steps and requirements- Detailing the environmental permit process, including the environmental permit, environmental agreement and environmental permit. Simulation on a real or hypothetical case study.	Presentation / Problematization / Presentation of case studies	
S 4 – Legal obligations and good practices for economic operators- Analysis of the obligations of economic operators in relation to environmental	Presentation / Problematization / Presentation of case studies	

legislation (monitoring, reporting, preventive measures). Case study on the compliance of an operator with environmental requirements.		
S 5 – Emission monitoring and management of hazardous substances- Presentation of the methods and tools used to monitor industrial emissions. Analysis of emission limit values and management of hazardous substances. Applied case study.	Presentation / Problematization / Presentation of case studies	
S 6 – Field trip to an economic operator- Direct observation of technological flows for the identification and assessment of environmental risks associated with industrial activities.	Fieldwork / presentation / discussio	
S 7 – Preventing industrial pollution by applying circular economy principles- Studying methods to prevent pollution through clean technologies and implementing the circular economy.	Presentation / Problematization / Presentation of case studies	
S 8 – Environmental risk assessment for industrial activities- Analysis of the processes for reviewing and updating the permitting conditions according to the identified environmental risks.	Presentation / Problematization / Presentation of case studies	
S 9 – Innovative technologies for pollution prevention in industry- Comparison of technologies for reduction, reuse and recycling, with a focus on best available practices (BATs).	Presentation / Problematization / Presentation of case studies	
S 10 – Planning and implementation of a sustainable industrial project - Analysis of the steps necessary for the development of a sustainable industrial project. Applying sustainable planning tools, in order to minimize the associated risks.	Presentation / Problematization / Presentation of case studies	
S 11 – Implementation of Best Available Techniques (BATs)- Case study on the application of BATs, with a focus on transparency and public involvement in decision-making.	Presentation / Problematization / Presentation of case studies	
S 12 – Final seminar colloquium -	Colloquium-type examination	

Presentation and debate of the challenges and opportunities identified in the individual projects and case studies.		

References

- Dellise, Marie, Jonathan Villot, Rodolphe Gaucher, Anne Amardeil, and Valérie Laforest. "Challenges in assessing Best Available Techniques (BATs) compliance in the absence of industrial sectoral reference." Journal of Cleaner Production 263 (2020): 121474.
- Lecomte, Thierry, Jose Felix Ferreria de La Fuente, Frederik Neuwahl, Michele Canova, Antoine Pinasseau, Ivan Jankov, Thomas Brinkmann, Serge Roudier, and Luis Delgado Sancho. Best available techniques (BAT) reference document for large combustion plants. Industrial emissions directive 2010/75/EU (Integrated pollution prevention and control). No. JRC107769. Joint Research Centre (Seville site), 2017.
- Zwikael, Ofer, and Mark Ahn. "The effectiveness of risk management: an analysis of project risk planning across industries and countries." Risk Analysis: An International Journal 31, no. 1 (2011): 25-37.
- Athar, Muhammad, Azmi Mohd Shariff, Azizul Buang, Muhammad Shuaib Shaikh, and Muhammad Ishaq Khan. "Review of process industry accidents analysis towards safety system improvement and sustainable process design." Chemical Engineering & Technology 42, no. 3 (2019): 524-538.

9. Mixing the contents of the discipline with the expectations of representatives of the epistemic community, professional associations and representative employers in the field related to the program

The course, seminars and field trips contribute to the development and capitalization of the student's creativity and own potential in scientific activities, cultivating an academic environment centered on democratic values and relations, as well as a positive and responsible attitude towards environmental issues.

10. Evaluation

Activity type	10.1 Grading criteria	10.2 Grading methods	10.3 Weight of the final grade
10.4 Course	- Knowledge and understanding	Written test	50%
10.5 Seminar/laboratory	- knowledge and understanding; - the ability to explain and interpret; - complete and correct resolution of requirements.	- application activity (laboratory/ practical work) - Control/Project Themes	50%
10.6 Minimum performance standard			
Acquiring the knowledge of the course, at a general level; The student knows what the main concepts are, recognizes them and defines them correctly; The specialized language is simple, but correctly used; Minimum grade 5 at the seminar or exam; Participation in at least 80% of the seminars			

Date	The signature of the course holder	The signature of the seminar holder
22.04.2019	Lector dr. Radovici Andrei	Lector dr. Radovici Andrei
	Radovici	Radovici

Departmental approval date

Signature of the department manager
Profesor dr. Cristina Roșu