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 Science/Environmental Analysis and Engineering
1.4 Field of Study	Environmental Science/Environmental Engineering
1.5 Study Cycle	Bachelor's Degree
1.6 Study Program / Qualification	Environmental Engineering, Environmental Science, Environmental Management and Audit Environmental Engineer

2. Course Information

2.1 Course Name	**Environment Integrated Monitoring**						
2.2 Course Instructor	Radovici Andrei						
2.3 Seminar Instructor	Radovici Andrei						
2.4 Study Year	II	2.5 Semester	4	2.6. Assessment Type	Exam	2.7 Course Status	Optional

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:					hours
Study from the textbook, course materials, bibliography, and notes					10
Additional research in the library, on specialized electronic platforms, and in the field					10
Preparation for seminars/laboratories, assignments, papers, portfolios, and essays					10
Tutoring					8
Exam					4
Other:					0

3.7 Total hours of independent study	42
3.8 Total hours per semester	98
3.9 Credits	4

4. Prerequisites (where applicable)

4.1 Curriculum prerequisites	• Mandatory: Fundamentals of Environmental Engineering; Recommended: Environmental Chemistry; Environmental Physics; Geographic Information Systems (GIS) applied to the environment.
4.2 Skill prerequisites	• Knowledge of basic concepts regarding environmental factors and chemical analytical techniques.

5. Conditions (where applicable)

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

6. Specific skills acquired

Professional skills	• Mastery of practical skills related to sample collection, conducting in situ measurements, performing various types of laboratory analyses, processing, examining, and interpreting analytical results. • Familiarity with the aggregation and presentation of environmental data for the preparation of environmental reports. • Practical skills in organizing the monitoring of processes with a negative impact on the environment, • The ability to correctly interpret the obtained results, culminating in forecasts and warnings. • The ability to propose realistic solutions from a constructive and material perspective.
Transversal skills	• Teamwork skills, • Use of information and communication technology, • Problem-solving and decision-making skills, • Application of efficient and responsible work strategies, including punctuality, seriousness, and personal accountability.

7. Course Objectives (derived from the competencies acquired)

7.1 General Objective	Students will be familiarized with the concept of integrated environmental monitoring, with the practical methods for its implementation, the methods of obtaining environmental data, the processing of this information, and the selection of environmental indicators for analyzing environmental impacts.
7.2 Specific Objectives	1. **Knowledge and Understanding** • Identifying terms, relationships, and processes, and understanding connections within integrated environmental monitoring. • Correct use of specialized terminology in the field of integrated environmental monitoring. • Ability to synthesize and interpret information accurately. 2. **Explanation and Interpretation** • Understanding the need for an integrated approach in environmental monitoring and management. • Making connections between environmental pressures and environmental quality. • Ability to analyze and apply generic models to specific situations. 3. **Practical-Instrumental** • Relating elements that characterize monitoring and management activities. • Describing states, systems, processes, and phenomena in the environment and identifying their correlations. • Ability to apply the knowledge gained in the course practically. • Research skills and creativity in environmental monitoring. • Ability to design environmental monitoring projects at various scales. 4. **Attitudinal** • Engagement in scientific activities related to integrated environmental monitoring. • Ability to collaborate with specialists from other fields.

8. Contents

8.1 Course	Teaching Methods	Observations

Topic 1: The Monitoring Concept. Introductory Concepts: Defining the Environmental Monitoring System; Environmental Quality and Monitoring.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods	
Topic 2: Environmental Monitoring Systems. General Overview. General Structure of an Environmental Monitoring System. Integrated Environmental Monitoring Internationally. The National Integrated Environmental Monitoring System in Romania.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods	
Topic 3: Parameters used in Integrated Monitoring. Investigation Areas. Environmental Components Monitored. Working Techniques. Duration and Frequency of Observations. Data Processing Methods. General Structure.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods	
Topic 4: Air Management and Monitoring. Overview. Sources of Atmospheric Pollution. Dispersion of Pollutants in the Atmosphere. Air Quality Monitoring. European Directives on Air Protection.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods combinate	
Topic 5: Water Environment Management and Monitoring. Overview. Pollution Sources. The New Concept of Integrated Water Monitoring. Organization of the Water Monitoring Network.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods	
Topic 6: Water Framework Directive. River Basin Management Plans.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods	
Topic 7: Soil Quality Monitoring. Overview. Soil Pollution. Integrated Soil Monitoring. Soil Quality Monitoring in Romania. Legislation.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods combinate	
Topic 8: Noise Monitoring. Overview. Noise Pollution. Noise Monitoring. Legislation on Noise Pollution.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods combinate	
Topic 9: Biological Monitoring and Biomonitoring. Overview. Bioindicators. Vegetation Monitoring.	PRESENTATION: explanation, discussion of the material TRAINING: interactive discussions OBSERVATION: case studies, mixed methods	

References

- Artiola, J. F., Pepper, I. L., and Brusseau, M. L., Environmental Monitoring and Characterization, Elsevier Academic Press, San Diego, 2004
- Căluianu, T., Cocirova, S., Măsurarea şi controlul poluării atmosferei, Ed Matrixrom Bucureşti 2004
- Clarke, Robin, The Handbook of Ecological Monitoring, Clarendon Press, Oxford, 1986

- Dumitru, M., Dumitru E., Gament, E., Carstea S., Monitoringul stării de calitate a solurilor din România, Institutul de Cercetări pentru Pedologie şi Agrochimie, Ed. G.N.P., Bucureşti, 2000
- Godeanu, S., Elemente de monitoring ecologic integrat., Ed. Bucura Mond, Bucureşti, 1997
- Healy, M., Donald L. Wise, Murray Moo-Young (Ed.), Environmental Monitoring and Biodiagnostics of Hazardous Contaminants, Kluwer Academic Publishers, 2001
- Mandravel, Cristina, Rodica Stănescu Dumitru, Metode fizico-chimice aplicate la măsurarea noxelor în mediul profesional, Ed. Academiei Romane, Bucuresti 2003
- Markert B (Ed.), Environmental Sampling for Trace Analysis, Weinheim: VCH, 1994
- Mihăiescu, R., Monitoringul integrat al mediului, Suport de curs, 2012
- Rojanschi, V., Bran, Florina, Diaconu, Gheorghiţa, Protecţia şi ingineria mediului, Ed. Economică, Bucureşti, 2002.
- Spellerberg, F., J., Monitoring Ecological Change, Cambridge University press, 2005
- Varduca A., Sistemul de monitoring integrat al mediului din România, Rev. Mediul Înconjurător, vol. II, nr. 3-4, Bucureşti. 1991
- Wiersma G. Bruce (ed.), Environmental Monitoring, Boca Raton; London; New York: CRC Press, 2004.
- *** Ministerul Apelor, Pădurilor şi Protecţiei Mediului, Sistemul Naţional de Monitoring al Mediului. Master Plan, Bucureşti, 1993

8.2 Seminar / laboratory	Teaching Methods	Observations
1. Basic principles for measuring pollutants in the air, pollutants in surface waters, wastewater pollutants, and soil pollutants.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
2. Data processing related to environmental quality.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
3. Data processing methods in integrated monitoring (matrix methods, calculation of the global pollution coefficient).	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
4. Methodology to asess air quality and its pollution. Sampling methods. Use of mathematical models for air pollutant dispersion.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
5. Air quality standards. Calculation of quality indices. Analysis of quality indicators.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
6. Application of the methodological guide for creating atmospheric emission inventories. Case studies.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming	

	- OBSERVATION: case studies, combined methods	
7. Methodology for assessing natural water quality and evaluating their pollution levels. Surface water quality, drinking water quality. National standards for water quality.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
8. Water sampling. Calculation of quality indices. Analysis of quality indicators.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
9. Models for estimating water pollutants. Teamwork. Applications in a case study.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
10. Study visit to the Cluj-Napoca Wastewater Treatment Plant.	COMMUNICATION: exposure, - TRAINING: interactive discussions,	
11. Methodology for assessing soil quality and evaluating its pollution levels. Soil quality. National standards for soil quality.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
12. Soil sampling. Calculation of quality indices. Analysis of quality indicators.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
13. Methodology for assessing noise levels. National standards for noise. Noise sampling.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	
14. Noise maps. Interpretation and discussion.	COMMUNICATION: exposure, problematization of the exposed material - TRAINING: exercises, interactive discussions, brainstorming - OBSERVATION: case studies, combined methods	

References

- Corinaire
- Collection of environmental standards
- Environmental reports
- The updated national management plan related to the portion of the Danube river, the international hydrographic basin, which is included in the territory of Romania, 2021.
- Water Framework Directive 2000/60/EC
- Behmel, S., Damour, M., Ludwig, R., Rodriguez, M.J., 2016. Water quality monitoring strategies — A review and future perspectives, Science of the Total Environment 571, 1312–1329.

- Arrouays, D., Mulder, V. L., Richer-de-Forges, A. C., 2021. Soil mapping, digital soil mapping and soil monitoring over large areas and the dimensions of soil security – A review. Soil Security, Volume 5, 100018.
- Singh, D., Dahiya, M., Kumar, R., Nanda, C., 2021. Sensors and systems for air quality assessment monitoring and management: A review. Journal of Environmental Management, Volume 289, 112510.
- https://www.earthdata.nasa.gov/learn/find-data/near-real-time/omps

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 subjects covered aim to bring students up to date with the topic of integrated environmental monitoring, providing them with a base of knowledge and useful skills in analyzing and interpreting environmental data and creating skills for systematizing information, drawing up environmental reports, valued skills by the representative employers in the field related to the program.

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	70%
10.5 Seminar/laboratory	- knowledge and understanding; - the ability to explain and interpret; - complete and correct resolution of requirements.	- application activities (laboratory/practical works) - control/ project homework	30%
10.6 Minimum performance standard			

- Acquiring the knowledge in the course, at a general level;
- The student knows what the main concepts are, recognizes and defines them correctly;
- The specialized language is simple, but correctly used;
- 5 as minimum grade at the seminar/laboratory;
- To draft and support a project according to the framework content.

Date	The signature of the course holder	The signature of the seminar holder
06/12/2024	Lecturer Radovici Andrei	Lecturer Radovici Andrei
	Radovici	Radovici
Departmental approval date		Signature of the department manager Profesor dr. Cristina Roșu