

COURSE DESCRIPTION

Advanced Methods in Sampling, Preparation and Analysis of Environmental Samples

Academic year 2026-2027

1. Programme-related data

1.1. Higher education institution	Universitatea Babeş-Bolyai
1.2. Faculty	Știința și Ingineria Mediului
1.3. Department	Departamentul de Analiza și Ingineria mediului
1.4. Field	Știința Mediului
1.5. Level of study	Masterat
1.6. Degree programme/Qualification	Dezvoltare Sustenabilă și Managementul Mediului
1.7. Form of education	ZI

2. Course-related data

2.1. Course title	<i>Advanced methods in sampling, preparation and analysis of environmental samples</i>			Course code	NME4322
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	2	2.5. Semester	IV	2.6. Type of assessment	Exam
2.7. Course status	Compulsory			2.8. Course type	Core subject

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

3.1. Number of hours per week	4	of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4. Total hours in the curriculum	48	of which: 3.5 course	24	3.6 seminar/laborator	24
Time allocation for individual study (IS) and self-taught activities (ST)					hours
Learning from textbooks, course materials, bibliography, and notes (IS))					30
Additional research in the library, on subject-specific electronic platforms, and on-site					30
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays (greater than or equal to the total number of hours specified in the course calendar for evaluation tasks)					20
Tutoring (professional guidance)					10
Examinations					4
Other activities [i.e.: two-way communication with the course coordinator/tutor]					0
3.7. Total individual study hours					94
3.8. Total hours per semester					150
3.9. Number of ECTS credits					6

4. Prerequisites (where applicable)

4.1. curriculum related	<ul style="list-style-type: none"> It is advisable to promote disciplines in the categories of analytical chemistry, instrumental analysis, and physics.
4.2. skills related	<ul style="list-style-type: none"> Cognitive skills: possession of basic acquisitions in the fields of chemical analysis in general. 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. Affective-attitudinal skills: availability to be involved in the teaching process, in an active and interactive manner; availability to carry out complex experiments.

5. Conditions (if necessary)

5.1. course related	<ul style="list-style-type: none"> Classroom equipped with video projector and multi-media system.
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5.2. seminar /laboratory related	<ul style="list-style-type: none"> Laboratory equipped with related equipment: Equipment for sampling gaseous, liquid and solid samples, equipment for extracting and purifying extracts, computer.
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6.1. Competencies resulting from the completion of the degree programme (as referred to in the curriculum)¹

Professional competencies	
Competency code	Competency
PC1	Advise on chemical use reduction: Provide advice to reduce the use of chemicals such as pesticides, the emissions of various chemical substances to limit their impact on the environment, as well as shorten their risk for people. Keep up to date with regulations and policies in the field.
PC4	Investigate pollution: Identify the cause of pollution incidents, as well as its nature and the extent of the risks, by performing tests on the site of pollution as well as in a laboratory and performing research.
PC6	Ensure compliance with environmental legislation: Monitor activities and perform tasks ensuring compliance with standards involving environmental protection and sustainability, and amend activities in the case of changes in environmental legislation. Ensure that the processes are compliant with environment regulations and best
PC10	Test samples for pollutants: Measure concentrations of pollutants within samples. Calculate air pollution or gas flow in industrial processes. Identify potential safety or health risks such as radiation.
PC11	Manage air quality: Monitoring, audit and management of air quality, including remedial measures.
PC12	Perform scientific research: Gain, correct or improve knowledge about phenomena by using scientific methods and techniques, based on empirical or measurable observations.
Transversal competencies	
Competency code	Competency
TC1	Think analytically:
TC2	Work in teams:

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)²

Learning outcomes targeted by the subject		
Competency code	Knowledge and comprehension	Specific academic skills
PC1, PC4 PC6, PC10, PC11, TC1, TC2	1. The student/graduate identifies and describes the principles and methods of air, water and soil quality management, including pollution, depollution and waste recovery processes.	1. The student/graduate applies methods for the assessment, monitoring and management of environmental quality factors.
PC10, PC11, PC12, TC1	2. The student/graduate identifies and describes advanced analytical techniques for the detection and quantification of chemical pollutants, as well as methods for sampling, preparation and analysis of environmental samples.	2. The student/graduate applies advanced analytical techniques for measuring pollutant concentrations in environmental samples. The student/graduate selects appropriate sampling and analysis methods depending on the type of sample

7. Subject-specific learning outcomes (referred to by each subject coordinator across the range of competencies and learning outcomes at the level of the degree programme)

Knowledge and comprehension
1. The student knows, understands, analyzes and applies, from an inter- and trans-disciplinary perspective, the phenomena and processes related to advanced and ultra-high-performance sampling and processing analytical techniques for investigating environmental quality.
2. The student knows how to choose the appropriate environmental investigation techniques, depending on the polluting factors and the environmental compartments targeted

3. The student has the ability to work independently to choose the most appropriate techniques for taking and processing environmental samples for the analysis of chemical pollutants.
4. The student has the ability to work independently to inform, document, and use information technologies for the acquisition and processing of analytical data.
Specific academic skills
1. The student is able to determine the concentration levels of chemical pollutants, with an emphasis on hazardous chemical compounds at trace levels.
2. The student acquires extremely useful practical skills related to the determination of chemical pollutants through advanced analytical techniques.
3. The student has the ability to make a pertinent and contextualized choice of analytical methods / techniques / optimizations in strict accordance with the concrete situations and the available resources.
4. The student is able to use the quality standards of environmental factors and their areas of applicability.
5. The student is able to determine the concentration levels of chemical pollutants, with an emphasis on hazardous chemical compounds at trace levels.

8. Content

8.1 Course	Teaching and learning methods	Remarks
<p>CONTENT: MODULE 1. Gaseous sampling methodologies. Active versus passive sampling. [4 hours] MODULE 2. Liquid and solid sampling methodologies. [4 hours] MODULE 3. Liquid sample processing. Liquid-liquid extraction. Solid-phase extraction. Applications to environmental samples. [4 hours] Module 4. Solid sample processing. Soxhlet extraction. QuEChERS technique. [4 hours] MODULE 5. Advanced environmental sample processing techniques. Supercritical fluid extraction. Ultrasound-assisted extraction. Microwave-assisted extraction. Head-Space technique. Purge and trap technique. [4 hours] Module 6. Miniaturized extraction techniques. Solid-phase microextraction. Liquid-phase microextraction. Applications to environmental samples. [4 hours] TOTAL: 24 hours / semester (2 hours / week x 12 weeks).</p>	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 applied 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.
<p>Bibliography:</p> <ol style="list-style-type: none"> 1. Liteanu C., Gocan S., Bold A. - <i>Separatologie Analitică</i>, Ed. Dacia, Cluj-Napoca, 1981. 2. Gocan S. - <i>Cromatografia de înaltă performanță, Partea I-II</i>, Ed. Dacia, Cluj-Napoca, 1998-2000. 3. Săndulescu R., Roman L. - <i>Validarea metodelor de analiză și control. Bazele teoretice și practice</i>, Ed. Medicală, Cluj-Napoca, 1998. 4. Gocan S., Cobzac S. - <i>Metode moderne de prelucrare a probelor organice</i>, Ed. Risoprint, Cluj-Napoca, 2006. 5. Beldean-Galea M.S. - <i>Cours Support</i> - not edited material 6. Beldean-Galea M.S. - <i>Tehnici de extracție și analiză a antioxidanților alimentari</i>, Ed. Risoprint, Cluj-Napoca, 2017 <p>https://www.sciencedirect.com/ - Key words, extraction, environmental samples</p>		
8.2 Seminar / laboratory	Teaching and learning methods	Remarks
<p>CONTENT: 1. Environmental sampling methodology. Active versus passive sampling. Presentation of equipment and instrumentation. Laboratory and field examples. [4 hours]</p>	Problem-Based Learning Practical Experiment	Usually, practical experiments will be carried out in semi-groups of students, but there may also be some experiments that are demonstratively carried

<p>2. Gaseous sampling. Sampling on cartridges, sampling on filters, sampling of air as such. Application to the analysis of volatile organic compounds in air. [4 hours]</p> <p>3. Liquid-liquid extraction. Solid-phase extraction. Head-Space extraction. Presentation of analytical instrumentation. Processing and purification of extracts. Application to the extraction of polycyclic aromatic hydrocarbons from water. [4 hours]</p> <p>4. Soxhlet extraction. Ultrasound-assisted extraction. Presentation of analytical instrumentation Application to the extraction of organochlorine pesticides from soil. [4 hours]</p> <p>5. Miniaturized extraction techniques. Solid-phase microextraction. Liquid-phase microextraction. Application to the analysis of some drugs from water samples. [4 hours]</p> <p>6. Sampling of industrial pollutants. Sampling on colorimetric tubes, sampling on cartridges, sampling in microabsorption. [2 hours]</p> <p>8. Laboratory colloquium [2 hours]</p> <p>TOTAL: 24 hours / semester (2 hours / week x 12 weeks).</p>	<p>Problematization</p> <p>Exercises and Problem Solving</p> <p>Heuristic Conversation</p> <p>Explanation</p> <p>Modeling</p>	<p>out in front of the group of students.</p>
<p>Bibliography Similar to that provided in 8.1.</p>		

10. Evaluation

Activity type	9.1 Evaluation criteria	9.2 Evaluation methods	9.3 Percentage of final grade
9.4 Course	Correctness of answers	Exam	50%
	Ability to identify critical status issues		
9.5 Seminar/laboratory	The ability to apply acquisitions in various concrete situations The ability to solve problems and integrate the acquisitions acquired in the study of this discipline with the acquisitions of related disciplines.	Paper / portfolio	50%
		Continuous assessment, through oral verification tests	
9.6 Minimum standard of performance			
<ul style="list-style-type: none"> Knowledge of the basic concepts of the discipline and awareness of the interdependencies between them. Application of acquisitions to problem solving and practical applications Systematic integration of the acquisitions of this discipline with acquisitions characteristic of other disciplines of the master's program. 			

11. SDG Labels (Sustainable Development Goals)¹

	<p>Sustainable Development Generic label</p>
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¹ Keep only the labels that, according to the [Procedure for applying ODD labels in the academic process](#), suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „Not applicable.“.

								
								

Date:
22.04.2026

Signature of course coordinator

Signature of seminar coordinator

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Date of approval:
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Signature of the head of department

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