



No. _____ of _____

Form USAMV 0107030215

SUBJECT OUTLINE

1. Information on the programme

1.1. Higher education institution	University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca
1.2. Faculty	Agriculture
1.3. Department	III Protection of the environment and plants
1.4. Field of study	Environmental Engineering
1.5. Cycle of study ¹⁾	Bachelor
1.6. Specialization/ Study programme	Environmental Engineering
1.7. Form of education	IF

2. Information on the discipline

2.1. Name of the discipline	Methods for separating pollutants							
2.2. Holder of course activities	PhD Associate Professor. Antonia ODAGIU							
2.3. Holder of seminar / laboratory / project activities	PhD Associate Professor. Antonia ODAGIU							
2.4. Year of study	III	2.5. Semester	V	2.6. Evaluation type	Continue	2.7. Discipline status	Content ²	DD
							Compulsoriness ³	DO

3. Total estimated time(teaching hours per semester)

3.1. Number of hours per week - frequency form	4	Out of which: 3.2. lecture	2	3.3. seminar / laboratory / project	2
3.4. Total hours of the educational plan	56	Out of which: 3.5. lecture	28	3.6. seminar / laboratory	28
Distribution of the time fund					h
3.4.1. Study after manual, course support, bibliography and notes					20
3.4.2. Additional documentation in the library, on specialized electronic platforms and in the field					10
3.4.3. Preparation of seminars / laboratories / projects, topics, reports, portfolios and essays					10
3.4.4. Tutorials					4
3.4.5. Examinations					10
3.4.6. Other activities					
3.7. Total hours of individual study	56				
3.8. Total hours per semester	110				
3.9. Number of credits ⁴	4				

4. Preconditions (where applicable)

4.1. curriculum-related	Chemistry 1, Chemistry 2, Physics 1, Physics 2, Analytical Chemistry
4.2. of skills	Possession of basic knowledge in the fields of chemical analysis in general.

5. Conditions (where applicable)

5.1. for the course	Classroom equipped with video projector and multi-media system. The course takes place in plenary and is interactive. Students can intervene during the teaching of the topic with questions or examples on the topic of discussion. The time allocated to the course is strictly adhered to.
5.2. for the seminar / laboratory / project	Laboratory equipped with related equipment: chromatographic plates for thin layer chromatography, liquid and gas chromatography, equipment for extracting and purifying extracts, computer.



6. Specific skills acquired

Professional skills	<ul style="list-style-type: none"> Knowing, understanding, analyzing and applying in inter- and trans-disciplinary perspectives, phenomena and processes related to advanced and ultra-performing analytical separation techniques for investigating the quality of the environment. The ability of relevant and contextualized choice of analytical methods / techniques / optimizations in strict agreement with the concrete situations and the available resources. Determination of the levels of concentration of chemical pollutants, with emphasis on hazardous chemical compounds at the trace level. Choosing the appropriate environmental investigation techniques, depending on the polluting factors and the environmental compartments concerned. Acquiring extremely useful practical skills related to the determination of chemical pollutants through advanced separation techniques
Transversal competences	<ul style="list-style-type: none"> Development of the action competences - of information and documentation, of group activity, of argumentation and of use of information technologies for the acquisition and processing of analytical data. Competence to reflect - individually and collectively - on various issues, topics, issues. Exercise cognitive flexibility. Effective communication (verbal and written). Active and interactive participation of students in the teaching process.

7. The objectives of the discipline (based on the grid of specific skills acquired)

7.1. General objective	Acquiring knowledge on a number of applicable analytical techniques for the determination of chemical compounds in mixture from various environmental factors.
7.2. Specific objective	Acquisition of the basic concepts and principles with which the main analytical techniques for determining the chemical compounds in the mixture operate. Knowledge of the applicability domains of analytical separation techniques. Acquiring a set of practical skills specific to ultra-tracking chemical analysis, including instrument calibration and validation of analysis methods.

8. Contents

8.1. .COURSE	Teaching methods	Remarks
NUMBER OF HOURS – 28 Introduction to Analytical Separatology. Requirements. Performance. Applicability.	Lecture, interactive discussions	4 hours
Classification of analytical separation techniques. Retention mechanisms. Gaussian distribution. peak chromatography	Lecture, interactive discussions	4 hours
Sizes specific to analytical techniques separation. Retention parameters. Capacity factor. Resolution. Asymmetry. Qualitative and quantitative analysis.	Lecture, interactive discussions	4 hours
Chromatography in liquid phase. Types of chromatographic methods in liquid phase. Thin layer chromatography. Column chromatography. HPLC, IC	Lecture, interactive discussions	4 hours
Gas chromatography. Instrumentation. Electrophoretic techniques. Coupled techniques. TLC-MS, HPLC-MS, GC-MS Bi- and multidimensional separation methods.	Lecture, interactive discussions	4 hours



Introductory notions. Orthogonality. Pick capacity. Construction and representation of the chromatogram.	Lecture, interactive discussions	4 hours
Notions of validation of analytical methods. Processing and interpretation of measurement data.	Lecture, interactive discussions	4 hours
8.2. PRACTICAL WORK Number of hours - 28		
Separation techniques used in the assessment of environmental pollution.	Problematization, ppt presentations, Reports	8 hour
Techniques and methods for processing environmental samples to obtain pollutant extracts, analyzable	Problematization, ppt presentations, Reports	10 hours
Validation of a pollutant separation method. Case Study	Problematization, ppt presentations, Reports	8 hour
Checking knowledge	Presentations regarding ppt	24 hours
<i>Required bibliography:</i> Liteanu C., Gocan S., Bold A. - Separatologie Analitica, Editura Dacia, Cluj-Napoca, 1981. Simion Gocan - Cromatografia de inalta performanta, Partea I-II, Editura Dacia, ClujNapoca, 1998-2000. Robert Sandulescu, Liviu Roman - Validarea metodelor de analiza si control. Bazele teoretice si practice, Editura Medicala, Cluj-Napoca, 1998.		
<i>Optional bibliography:</i> Petrovicy M. et al. Environmental Analysis: Emerging Pollutants, Liquid Chromatography: Application, Cap 14. Elsevier, 2013, http://dx.doi.org/10.1016/B978-0-12-415806-1.00014-0 Blumberg L.M., Theory of Gas Chromatography, Cap. 2, Gas chromatography, Elsevier, 2012, file:///C:/DOCUME~1/SIMION/LOCALS~1/Temp/3-s2.0-B978012385540400002X-main.pdf Jennings G., C.F. Poole ,Chapter 1 - Milestones in the Development of Gas Chromatography, Gas Chromatography, 2012, pp. 1-17, http://ac.els-cdn.com/B9780123855404000018/3-s2.0B9780123855404000018-main.pdf?_tid=cb9e58c0-5136-11e4-99df00000aab0f27&acdnat=1413025831_2cb60f78084b872ddebba9d71ad84d7e		

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

The discipline integrates with areas of critical interest currently internationally, such as the detection and determination of chemical compounds at trace levels present in the mixture in various environmental factors. The studied discipline offers the graduates the ability to contribute to solving complex situations related to pollution and its effects.

10. Evaluare

Activity type	10.1. Evaluation criterias	10.2. Methods of evaluation	10.3. Weight in the final grade
10.4. Cours	The correctness of the answers The ability to identify problems with critical status	continue	70%



10.5. Seminar / Laboratory	The ability to apply a purchases in various situations concrete The ability to apply a purchases in various situations concrete	Continuous evaluation, by means of oral verification tests	30%
	The ability to solve problems and integration of acquisitions acquired in the study this discipline with the acquisitions specific to related disciplines.	Case Study	15%
10.6. Minimum standard of performance			
Knowledge of 70% of the information contained in the course and Knowledge of 60% of the information from the seminar.			

- ¹ The cycle of studies - one of the variants is chosen - Bachelor / Master / Doctorate
- ² The regime of the discipline (content) - for the license level one of the variants is chosen - DF (fundamental discipline), DD (discipline in the field), DS (specialty discipline), DC (complementary discipline).
- ³ The regime of the discipline (compulsory) - one of the variants is chosen - DI (compulsory discipline) DO (optional discipline) DFac (optional discipline).
- ⁴ The regime of the discipline (compulsory) - one of the variants is chosen - DI (compulsory discipline) DO (optional discipline) DFac (optional discipline).

Date completed
04.09.2019

Course holder
PhD Associate Professor, Antonia ODAGIU

Holder of laboratory works / seminars
PhD Associate Professor, Antonia ODAGIU

Date of approval in the department
05.09.2019

Department Director
Professor, PhD Ioan OROIAN