



No. _____ of _____

USAMV form 0107010113

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	Environmental and plant protection
1.4. Field of study	Environmental Engineering
1.5. Cycle of study¹	Bachelor
1.6. Specialization/ Study programme	Environmental Engineering
1.7. Form of education	Full time

2. Information on the discipline

2.1. Discipline name		Instrumental analysis						
2.2. Course coordinator		Associate Professor PhD Tania MIHĂIESCU						
2.3. Seminar/ laboratory/ project coordinator		Associate Professor PhD Tania MIHĂIESCU						
2.4. Year of study	I	2.5. Semester	II	2.6. Evaluation type	Sumative	2.7. Discipline status	Content ²	DD
							Compulsoriness ³	DI

3. Total estimated time (teaching hours per semester)

3.1. Hours per week - full time programme	4	out of which: 3.2. lecture	2	3.3. seminar/ laboratory/ project	2
3.4. Total number of hours in the curriculum	56	out of which: 3.5. lecture	28	3.6. seminar/ laboratory	28
Distribution of the time allotted					hours
3.4.1. Study based on books, textbooks, bibliography and notes					15
3.4.2. Additional documentation in the library, electronic platforms and field experiences					8
3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays					15
3.4.4. Tutorials					2
3.4.5. Examinations					4
3.4.6. Other activities					
3.7. Total hours of individual study	44				
3.8. Total hours per semester	100				
3.9. Number of credits⁴	4				

4. Prerequisites (if applicable)

4.1. curriculum-related	Chemistry I
4.2. skills-related	team communication skills, organization, use of the internet as a resource.

5. Conditions (if applicable)

5.1. for the course	The course is interactive, students can ask questions about the content of the exhibition. Academic discipline is required for the entire duration of the lecture. No other activities are tolerated during the lecture, mobile phones must be switched off. Room equipped with computer, video projector, Internet access, blackboard.
5.2. for the seminar/ laboratory/ project	Punctuality, appropriate attire (overall) The observance of academic conduct, of technical and work safety norms, and of the procedures regarding fire prevention and extinguishing required during the entire duration of the practical experiments.

6. Cumulated specific competences

Professional competences	<p>Description and application of the concepts, theories and practical methods for determining the quality of the environment;</p> <p>Choosing the principles and establishing the appropriate basic methods for solving problems;</p> <p>Knowledge transfer from theory to practice;</p> <p>Identification and use of instrumental analytical techniques required to monitor environmental factors;</p> <p>Selection of analytical methodologies according to the specificity of the environmental factors (water, air, soil) and their typology;</p> <p>Definition and use of the terminology specific to the instrumental analysis in connection with the multidisciplinary terminology specific to the domain.</p>
Transversal competences	<p>Identifying and observing the rules of professional ethics and deontology, taking responsibility for the decisions taken and the risks involved;</p> <p>Defining and respecting the competences of the team, distributing responsibilities to the team members and solidarity in assuming responsibilities;</p> <p>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 a language of international circulation.</p>

7. Discipline objectives (based on the cumulated specific competences)

7.1. General objective	Acquiring knowledge regarding the analytical instrumental techniques, applicable to the detection of chemical pollutants and used in monitoring the quality of the environment (air, water, soil, etc.).
7.2. Specific objectives	<p>Acquiring knowledge of the principles of instrumental analysis techniques (Molecular spectrophotometry, atomic UV-VIS spectrophotometry, electroanalytical techniques) used to check the quality of the environment.</p> <p>Acquiring the basic knowledge related to the techniques of sampling, storage and preparation of environmental samples.</p> <p>Acquiring the basic concepts and principles with which the essential instrumental analytical techniques operate.</p> <p>The formation and development of exploration, observation and experimentation by the use of equipment, apparatus, equipment, reagents and operations</p> <p>Formation of basic skills in order to perform instrumental analyzes through individual involvement in concrete chemical analyzes.</p> <p>Appropriate use of specific terminology in the context of environmental engineering applications.</p>

8. Content

8.1. COURSE Number of hours – 28	Teaching methods	Observation
1. Introduction to instrumental analysis.	oral lectures with interactive sections	2 hours
2. Evaluation of analytical data.		4 hours
3. Electrochemical methods.		2 hours
4. Nephelometry and turbidimetry.		2 hours
5. Optical methods.		4 hours
6. IR absorption spectrometry.		2 hours
7. The atomic absorption analysis.		4 hours
8. Emission spectrometry.		2 hours
9. Fluorimetry and chemiluminescence spectrometry.		2 hours
10. Chromatographic methods.		4 hours
8.2. PRACTICAL WORKS Number of hours – 28	Teaching methods	Observation
1. Work instructions and norms of laboratory safety technique in the laboratory. Work organization, fire prevention and extinction rules and first aid measures in case of accidents. Presentation of laboratory work.	Oral lecture with interactive sections	2 hours
2. Analytical techniques for sample preparation.	Oral lecture with interactive sections. Experiment.	2 hours
3. Evaluation of analytical data. Calculations.	Oral lecture with interactive sections. Exercise. Solving problems.	6 hours
4. Determination of pH from water and soil samples.	Demonstration. Work practice	2 hours
5. Determination of water turbidity.	Demonstration. Work practice	2 hours

6. Spectrophotometric determination of N and P compounds in water and soil samples.	Demonstration. Work practice	6 hours
7. Analysis of heavy metals by AAS from water and soil samples.	Demonstration. Work practice	4 hours
8. Verification of knowledge	Practical evaluation	4 hours
Compulsory bibliography:		
1. Mihăiescu Tania, 2019, <i>Instrumental analysis, Course notes</i>		
Optional bibliography:		
1. Harvey, D., 2000, <i>Modern analytical chemistry, The McGraw-Hill Companies, Inc. USA</i>		
2. Muntean, E., 2006, <i>Chimie analitică și analiză instrumentală: tehnici de lucru și aplicații de calcul. Editura AcademicPres Cluj-Napoca.</i>		
3. Muntean, E., 2007, <i>Chimie analitică și analiză instrumentală. Editura AcademicPres Cluj Napoca.</i>		
4. Nașcu, H. Iustin și Jăntchi, L., 2006. <i>Chimie analitică și instrumentală. AcademicPres: AcademicDirect, Cluj Napoca.</i>		

9. Corroborating the discipline content with the expectations of the epistemic community representatives, of the professional associations and of the relevant employers in the corresponding field

<ul style="list-style-type: none"> • By acquiring the theoretical-methodological concepts and approaching the practical aspects included in the discipline Instrumental analysis students acquire a consistent knowledge bag, in accordance with the partial competences required for the possible occupations provided in Grid 1 - RNCIS. • The activities carried out by the students will follow the development of the individual work capacities, of analysis and interpretation of the results, of the capacity to offer solutions to practical problems. • The discipline responds concretely to the current requirements of development and evolution at national and international level of the higher education, as well as of the economic environment in the field of environmental engineering. • The syllabus is related to similar study programs of other universities in Romania and Europe that apply the Bologna system. • The fields of activity concerned are practically unlimited, the possible employers targeted being from both the educational environment, as well as public institutions at central (ministries) and local (county and municipal councils), Environmental Agencies, Romanian Water Administration, Environmental Guard, of the research-development environment, but also organizations / associations / companies that provide consulting in the field of engineering and environmental protection or national / international / multinational companies with activities in the field. • The students are provided with adequate competences with the needs of current qualifications, an adequate scientific and technical training, which will allow them to quickly enter the labour market after graduation, but also the possibility of continuing their studies through masters and doctoral programs.
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10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation type	10.3. Percentage of the final grade
10.4. Course	Fairness responses, learning and understanding issues being treated. Practical vision in solving an analytical problem	summative(E) Written exam (multiple choice test)	60%
10.5. Seminar/Laboratory	Laboratory activity. Solving computing applications. The quality of the activity carried out. Quality of prepared reports	The laboratory reports corresponding to the practical works are to be delivered in the week following the execution of the activity	40%

10.6. Minimum performance standards

Course

Fulfillment of at least 50% of the evaluation criteria for the course:

- Classification of instrumental analysis methods.
- Performance criteria of the analysis methods.
- List the main causes of systematic errors;
- Types of flames used in FAAS;
- Electrolytic cell.
- Drawing and explanation;
- The main advantages of the instrumental analysis methods;
- Analytical instrumentation used for optical methods;
- Examples of reference electrodes;
- Applications of UV-VIS spectrophotometry, polarography;
- Lambert-Beer Law.

Access to the exam is conditioned on performing all Laboratory work and delivery of reports.

Laboratory

50% knowledge of the information obtained after the laboratory hours and the delivery of all laboratory reports on time.

- 1 Cycle of studies - choose one of the three options: Bachelor/Master/Ph.D.
- 2 according to the educational plan
- 3 Discipline status (compulsoriness) - choose one of the options - DI (compulsory discipline) DO (optional discipline) DFac (facultative discipline).
- 4 One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

Filled in on
04.09.2019

Course coordinator
Associate Professor PhD Tania MIHĂIESCU

Laboratory work/seminar coordinator
Associate Professor PhD Tania
MIHĂIESCU

Approved by the
department on
05.09.2019

Head of the Department
Professor PhD Ioan OROIAN