R O M Â N I A
MINISTERUL EDUCAȚIEI ȘI CERCETĂRII
Universitatea din Craiova
FACULTATEA DE ȘTIINȚE/ DEPARTAMENTUL DE CHIMIE
Craiova, Str. Calea București, nr. 107I
Tel/ fax: 0251597048, e-mail: chimie@ucv.ro

Subject Description

1. Program information

1.1. Institution	University of Craiova
1.2. Faculty	Science
1.3. Department	Chemistry
1.4. Study field	Chemistry
1.5. Study level	Master
1.6. Type of education	full-time
1.7. Study program	Advanced Chemistry

2. Subject information

2.1. Subject			**Coupled techniques in analytical control**				
2.2. Course coordinator			Prof.dr. Mihaela Mureșeanu				
2.3. Application coordinator			Prof.dr. Mihaela Mureșeanu				
2.4. Year of study	I	2.5. Semester	1	2.6. Type of evaluation	E	2.7. Subject type	DS/DOB

3. Total estimated tipe (hours/semester)

3.1. Number of hours per week	4	from which: 3.2 course	2	3.3. seminar/lab	2
3.4. Total hours in curriculum	56	from which: 3.5 course	28	3.6. seminar/lab	28
Time allocation – hours/week					
Study using textbooks, course materials, bibliographies, and notes					25
Additional documentation in the library, on specialized electronic platforms, and in the field					20
Preparation of seminars/labs, assignments, reports, portfolios, and essays					15
Tutoring					5
Examinations					4
Other activities.....					
3.7. Total hours of individual study					69
3.8. Total hours per semester					125
3.9. Number of ECTS					5

4. Preconditions (if the case)

4.1. of curriculum	• Knowing the basic concepts of analytical chemistry and instrumental analysis
4.2. of competences	• Basic knowledge of chromatography and spectroscopy

5. Conditions (if the case)

5.1. for course	• Lecture hall equipped with computer, video projection system, and internet connection
5.2. for labs	• Laboratory equipped with the materials, equipment, and reagents necessary to carry out experimental work

6. Course objectives - expected learning outcomes achieved by completing and passing the course

Knowledge	1. Graduates define, understand, explain, and apply advanced knowledge of chemistry from specialized literature in practice. 2. Graduates select and use appropriate experimental and theoretical methodologies to investigate complex scientific problems, assessing their impact on the environment and society. 3. Graduates write analysis and scientific reports, presenting the results of their research and experiments, in line with professional ethics and standards. 4. The graduate describes and integrates interdisciplinary knowledge into the implementation of research projects.
Skills	1. Graduates apply major concepts in analytical, inorganic, organic, and physical chemistry to chemical practice. 2. Graduates evaluate and analyze experimental techniques to conduct and design experiments, analyze and test (qualitatively and quantitatively) chemical elements and substances; design, coordinate, and conduct chemical experiments. 3. Graduates apply critical thinking, following the structure and principles of scientific writing to develop and present scientific reports. 4. Graduates apply interdisciplinary methods to solve complex theoretical and practical chemical problems in their professional and research activities.
Responsibility and authonomy	1. Graduates are able to adapt major scientific concepts in the field of chemistry to conduct research, improve or develop new concepts, knowledge, theories, and operational methods, products, and services in order to apply them in specific activities for product and process quality control. 2. Graduates use classical laboratory instruments/techniques and modern equipment independently, design experiments, and interpret and analyze the obtained results accurately. They design learning situations focused on developing experimental techniques and methods specific to chemical laboratories. 3. Graduates prepare and present scientific reports in line with ethical standards for collecting and interpreting results. 4. Graduates assume responsibility for managing interdisciplinary collaborations and coordinating activities within work and research teams..

7. Table of contents

7.1. COURSE	Mode of operation	Teaching methods	Allocated time (hours)
1. Introduction to hyphenated techniques and analytical control • General considerations • Characteristics of the most used coupled techniques (GC-MS, LS-MS, LC-MS-MS, ICP-MS, GC-FTIR, HPLC-DAD) • Fundamental of coupling analytical techniques	On site (week 1)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	2
2. Gas chromatography: • Types of capillary columns • Characteristics • Special stationary phases • Selective injection systems	On site (week 2)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	2
3. Gas chromatography-mass spectrometry (GC-MS) • Interfaces • Characteristics • Equipment	On site (week 3-4)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	4

• Applications			
4. Liquid chromatography • Types of columns • Characteristics • Stationary phases in HPLC • Microcolumn techniques	On site (weeks 5)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	2
5. Mass spectrometry • Types of fragmentation (electron impact ionization, chemical ionization, special types of ionization chambers) • Mass analyzers (with magnetic or electric field, double focussing, magnetic quadrupole, time-of-flight analyser)	On site (week 6-7)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	4
6. Liquid chromatography–mass spectrometry (LC–MS and LC–MS/MS) • LC/MS techniques • Transport interfaces • Direct inlet LC/MS interfaces • Applications of the electrospray LC/MS interface • Post column additives in LC/MS using electrospray iInterfaces • LC-MS/MS techniques	On site (weeks 8-9)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	4
7. Chromatomatography-spectroscopic technique coupling • LC/UV tandem systems • GC/FTIR tandem systems	On site (week 10-11)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	4
8. Different strategies for sample preparation for tandem techniques • Derivatization techniques • Esterification • Acylation	On site (week 12)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	2
9. Method validation, quality control and standardization (ISO, GLP, GMP) in analytical control	On site (week 13)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	2
10. Application of tandem techniques of analysis in different fieds • Environmental • Food • Pharmaceutical • Industrial	On site (week 14)	Lecture, explanation and interactive presentation, heuristic conversation, problem solving	2
References:			
1. Scott, R. P. W. (Editor): Tandem Techniques. In Separation Science Series, John Wiley &Sons 1997. ISBN 0-471-96760-2			
2. Skoog, D.A., Holler, F.J., CrouchS.R., Principles of Instrumental Analysis, Seven Edition, Cengage Learning. 2018. ISBN 978-1-305-57721-3			
3. Niessen, W. M. A., Liquid Chromatography–Mass Spectrometry, CRC Press 2006. eBook ISBN 9780429116803			

4. Lecture notes, 2025

7.2. Lab	Mode of operation	Teaching methods	Allocated time (hours)
1. Safety rules in Coupled techniques in analytical control lab	On site (week 1)	Experiment, explanation, discussion, debate, and questioning	4
2. Application of coupled techniques in coriander oil analysis	On site (week 3)	Experiment, explanation, discussion, debate, and questioning	4
3. Application of coupled techniques in analysis of Coca-Cola flavor	On site (week 5)	Experiment, explanation, discussion, debate, and questioning	4
4. Combined techniques for environmental analysis	On site (week 7)	Experiment, explanation, discussion, debate, and questioning	4
5. Analysis of esterified lanolin	On site (week 9)	Experiment, explanation, discussion, debate, and questioning	4
6. Analysis of waxes and lipid type materials by coupled techniques	On site (week 11)	Experiment, explanation, discussion, debate, and questioning	4
7. Lab Verification	On site (week 13)	Experiment, explanation, discussion, debate, and questioning	4
References:			
1. Lab work presentations, 2025.			

8. Corrrelation of the discipline content with the expectations of representatives of the epistemic community, professional associations, and representative employers in the field related to the program

The content of the course is in line with those of similar courses at universities in Romania and abroad, while also meeting the expectations of professional associations and representative employers in the field.

9. Evaluation

Activity	9.1. Evaluation criteria	9.2. Evaluation method	9.3. Contribution to final score
9.4. Course	theoretical principles of major coupled analytical techniques, critical analysis of complex analytical data from analytical control, evaluate method performance parameteres and regulatory requirements	Written Exam	50%
		Portofolio	20%
9.5. Lab	Use of advanced analytical instrumentation, data interpretation	Project Work	30%
9.6. Minimum performance standard			

• Basic understanding of the theoretical principles underlying major coupled analytical techniques. • Select appropriate hyphenated techniques for specific analytical control problems. • Correlation and interpretation of analytical data from coupled techniques. • Completion of practical/project tasks

Date
22.09.2025

Course coordinator,
Prof. dr. Mihaela Mureseanu

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Date of approval
25.09.2025

Head of Department,
Conf.dr. Nicoleta Cioateră