

**COURSE DESCRIPTION****1. Program data**

1.1 Higher education institution	“ALEXANDRU IOAN CUZA” UNIVERSITY OF IASI
1.2 Faculty	CHEMISTRY
1.3 Department	DOCTORAL SCHOOL OF CHEMISTRY
1.4 Field of study	CHEMISTRY
1.5 Cycle of studies	PHD
1.6 Study program / Qualification	PHD IN CHEMISTRY

**2. Discipline data**

2.1 Discipline title	MANAGEMENT OF INNOVATIVE RESEARCH METHODOLOGIES IN CHEMISTRY – MODULE I						
2.2 Course Activity Holder	Prof. univ. dr. Ionel MANGALAGIU Prof. univ. dr. habil. Mihail Lucian BIRSA Prof. univ. dr. Aurel PUI						
2.3 Owner of seminar activities	Prof. univ. dr. habil. Cecilia ARSENE						
2.4 Year of study	I	2.5 Semester	1	2.6 Type of evaluation	C	2.7 Discipline regime	CC

\* CC – Compulsory / OP – Optional

**3. Total estimated time (hours per semester and teaching activities)**

3.1 Number of hours per week	2	of which: 3.2. course	1.5	3.3. seminar	0.5
3.4 Total hours in the curriculum	28	of which: 3.5. course	21	3.6. seminar	7
Distribution of the time fund					hours
Study by textbook, course material, bibliography and others					15
Additional documentation in the library, on specialized electronic platforms and in the field					30
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					15
Tutoring					4
Examination					4
Other activities					4

3.7 Total individual study hours	72
3.8 Total hours per semester	100
3.9 Number of credits	4

**4. Preconditions (if applicable)**

4.1 Curriculum	-
4.2 Competences	-

**5. Conditions (if applicable)**

5.1 Course Conduct	
5.2 Conduct of the laboratory	-



## 6. Specific competences accumulated

<b>Professional skills</b>	<p>To conceive and carry out original research, based on advanced methods that lead to the development of scientific, technological knowledge and/or research methodologies.</p> <p>Critical-constructive evaluation of projects and results of scientific research, assessment of the state of theoretical and methodological knowledge; identifying the priorities of knowledge and application to the field</p> <p>Selection and application of principles, theories and advanced methods of knowledge, transfer of methods from one field to another, interdisciplinary approaches to solve theoretical and practical problems, new and complex</p> <p>The use of advanced principles and methods for explaining and interpreting, from multiple perspectives, new and complex theoretical and practical situations/problems, specific to the field.</p> <p>Systematic, advanced knowledge of concepts, research methods, controversies and new hypotheses specific to the field; communication with specialists in related fields.</p>
<b>Transversal competences</b>	<p>Development of projects centered on creativity, as a basis for self-realization</p> <p>Assuming responsibility and capacity to organize and manage the activity of professional groups, scientific research or organizations/institutions</p> <p>Initiation and innovative development of complex theoretical and practical projects</p>

## 7. The objectives of the discipline (from the grid of specific skills accumulated)

<b>7.1. General objectives</b>	<p>The course aims to review the main modern experimental methodologies with which the doctoral student will work and to present the main ways of processing experimental data in order to maximize the exploitation of the results obtained and which can help in their correct interpretation.</p>
<b>7.2. Specific objectives</b>	<p><b>Upon successful completion of this discipline, students will be able to:</b></p> <ul style="list-style-type: none"> <li>• Knows the management of methodologies and modern experimental techniques;</li> <li>• Understand the meaning of the terms: discrete and random variables, population, probability density, probability distribution functions, moments of a probability distribution function, mean and variance, sample size, sampling distribution, sample parameters;</li> <li>• Process experimental data using statistical methods;</li> <li>• Compare own data with those from specialized literature using statistical methods;</li> <li>• Propose algorithms for estimating the degrees of uncertainty of one's own experimental data;</li> <li>• Knows the degree of correctness of the obtained data;</li> <li>• Eliminate erroneous data using statistical procedures.</li> </ul>

## 8. Content

<b>8.1</b>	<b>Course</b>	<b>Teaching methods</b>	<b>Observations</b> (hours, bibliographic references, procedure)
1.	Methodologies and techniques for sample preparation for analysis	Lecture, Explanation, Conversation, Description, Problematization	(3 hours, [1÷2]) C-CF&TAC-01
2.	Management of rapid chromatographic methods involved during compounds synthesis.	Lecture, Explanation, Conversation, Description, Problematization	(2 hours, [1÷2]) C-CF&TAC-02



3.	Management of spectrometric methods of analysis	Lecture, Explanation, Conversation, Description, Problematization	(3 hours, [1÷2]) C-CF&TAC-03
4.	Management of electrochemical analysis methods.	Lecture, Explanation, Conversation, Description, Problematization	(2 hours, [1÷2]) C-CF&TAC-04
5.	Advanced methods of mass spectrometry.	Lecture, Explanation, Conversation, Description, Problematization	(3 hours, [1÷2]) C-CF&TAC-05
6.	Problematization in the context of chemical analyses	Lecture, Explanation, Conversation, Description, Problematization	(2 hours, [1÷2]) C-CF&TAC-06
7.	Standard operating procedures in chemical analysis	Lecture, Explanation, Conversation, Description, Problematization	(2 hours, [3,4]) C-CF&TAC-07
8.	Basic concepts in statistics. Tools in the processing of experimental data	Lecture, Explanation, Conversation, Description, Problematization	(2 hours, [3,4]) C-CF&TAC-08
9.	Methods and techniques for characterizing analysis methods	Lecture, Explanation, Conversation, Description, Problematization	(2 hours, [3,4]) C-CF&TAC-09

**Bibliography:**

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis, Cengage Learning, Boston, USA 2016.
2. Rouessac, Francis; Rouessac, Annick, Chemical analysis : modern instrumental methods and techniques, Wiley, 2007.
3. Cecilia Arsene, Romeo Iulian Olariu, Metode analitico-statistice in investigarea sistemelor chimice, 241 p., ISBN: 978-973-730-606-7, PERFORMANTICA, Iasi, 2009.
4. Matthias Otto, Chemometrics. Statistics and Computer Application in Analytical Chemistry, Wiley-VCH Verlag GmbH, 2017.

8.2	Seminar	Teaching methods	Observations (hours, bibliographic references, procedure)
1.	Methodologies and techniques for sample preparation for analysis	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [1÷2]) S-CF&TAC-01
2.	Management of instrumental analysis techniques	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [1,2]) S-CF&TAC-02
3.	Standard procedures and operating methodologies in chemical analysis	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [3,4]) S-CF&TAC-03
4.	Methods of characterizing analysis methods	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [3,4]) S-CF&TAC-04
5.	The role of calibration management in chemical analysis	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [3,4]) S-CF&TAC-05
6.	Error estimation methodologies in chemical analyses	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [3,4]) S-CF&TAC-06
7.	Experience planning management and their optimization procedures	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [3,4]) S-CF&TAC-07

**Bibliography:**

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis, Cengage Learning, Boston, USA 2016.
2. Rouessac, Francis; Rouessac, Annick, Chemical analysis : modern instrumental methods and techniques, Wiley, 2007.
3. Cecilia Arsene, Romeo Iulian Olariu, Metode analitico-statistice in investigarea sistemelor chimice, 241 p., ISBN: 978-973-730-606-7, PERFORMANTICA, Iasi, 2009.
4. Matthias Otto, Chemometrics. Statistics and Computer Application in Analytical Chemistry, Wiley-VCH Verlag GmbH, 2017.

**9. Corroborating the content of the discipline with the expectations of the representatives of the community, professional associations and representative employers in the field related to the program**

After completing and advancing the discipline, the doctoral student will be able to identify a possible research topic and will be able to carry out a research project in a given topic based on a documented literature study

**10. Rating**

<b>Activity Type</b>	<b>10.1 Evaluation criteria</b>	<b>10.2 Evaluation methods</b>	<b>10.3 Weight in final grade (%)</b>
<b>10.4 Course</b>	Correctness of answers – understanding and correct application of the issues dealt with in the course. The degree of assimilation of the specialized language	Colloquium – Lecture on a research ethics problem	75
<b>10.5 Seminar</b>	Correctness of answers – understanding and correct application of the issues dealt with in the seminar	Lecture on a topic discussed in the seminar	25
<b>10.6 Minimum Performance Standard</b>			
<ul style="list-style-type: none"><li>▪ Know the meaning of the terms: discrete variables, random variables, probability distribution functions, mean, variance, sample size, sample distribution, sample parameters;</li><li>▪ To process experimental data using statistical procedures;</li><li>▪ To know the degree of correctness of the data obtained;</li><li>▪ Know a way to eliminate erroneous data through a statistical process</li></ul>			

Date of completion

Course holder

Seminar Holder

28.09.2022

Prof. univ. dr. Ionel MANGALAGIU

Prof. univ. dr. habil. Cecilia ARSENE

Prof. univ. dr. habil. Mihail Lucian BIRSA

Prof. univ. dr. Aurel PUI

Date of approval

Director of the Doctoral School of Chemistry  
Prof. univ. dr. habil. Cecilia ARSENE