



## 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	DOCTORATE
1.6 Study Programme/Qualification	DOCTOR OF CHEMISTRY

### 2. Discipline data

2.1 Name of the discipline	MANAGEMENT OF INNOVATIVE RESEARCH METHODOLOGIES IN CHEMISTRY – MODULE II						
2.2 Course Activity Holder	Prof. univ. dr. Aurel PUI Prof. univ. dr. Ionel MANGALAGIU Prof. univ. dr. habil. Romeo Iulian OLARIU Prof. univ. dr. habil. Mihail Lucian BIRSA						
2.3 Owner of seminar activities							
2.4 Year of study	I	2.5 Semester	1	2.6 Type of evaluation	C	2.7 Discipline regime	OB

\* OB – Mandatory / OP – Optional

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

3.1 Number of hours per week	1	of which: 3.2. course	1	3.3. Seminar	-
3.4 Total hours in the curriculum	14	of which: 3.5. course	14	3.6. Seminar	-
Distribution of the time fund					hours
Study by textbook, course material, bibliography and others					24
Additional documentation in the library, on specialized electronic platforms and in the field					46
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					14
Tutoring					-
Examination					2
Other activities					-
3.7 Total individual study hours					86
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><b>CP1:</b> 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><b>CP2:</b> Critical-constructive evaluation of projects and scientific research results, assessment of the state of theoretical and methodological knowledge; identification of knowledge and application priorities to the field.</p> <p><b>CP3:</b> 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><b>CP4:</b> Use of advanced principles and methods to explain and interpret, from multiple perspectives, new and complex theoretical and practical situations/problems, specific to the field.</p> <p><b>CP5:</b> Systematic, advanced knowledge of concepts, research methods, controversies and new hypotheses specific to the field; communication with specialists in related fields.</p>
<b>Transversal competence</b>	<p><b>CT1:</b> Development of projects centered on creativity, as a basis for self-realization.</p> <p><b>CT2:</b> Assuming responsibility and capacity to organize and manage the activity of professional groups, scientific research or organizations/institutions.</p> <p><b>CT3:</b> Initiation and innovative development of complex theoretical and practical projects.</p>

## 7. Objectives of the discipline (from the grid of specific competences accumulated)

<b>7.1. General objective</b>	The course aims to review the main modern experimental techniques with which the PhD student will work and to present the main ways of processing experimental data in order to maximize the exploitation of the obtained results and which can help to interpret them correctly.
<b>7.2. Specific objectives</b>	<p><b>Objective cognitive</b></p> <ul style="list-style-type: none"> <li>✓ Knowledge of modern experimental techniques and methods.</li> <li>✓ Understanding the meaning of terms: discrete and random variables, population, density probability, probability distribution functions, moments of a probability distribution function, mean and variance, sample size, sampling distribution, sample parameters.</li> </ul> <p><b>Procedural objectives</b></p> <ul style="list-style-type: none"> <li>✓ Competences in processing experimental data using statistical procedures.</li> <li>✓ Competences for establishing the degree of correctness of the data obtained.</li> </ul> <p><b>Attitudinal objectives</b></p> <ul style="list-style-type: none"> <li>✓ Ability to compare one's own data with those from the literature using statistical procedures.</li> <li>✓ Ability to propose algorithms to estimate the degrees of uncertainty of one's own experimental data</li> </ul>

## 8. Content

8.1	Course	Teaching methods	Observations (hours and bibliographic references)
1.	Techniques for preparing samples for analysis and analysis; Chromatographic, spectrometric, etc. methods of analysis.	Lecture, explanation, conversation, description, problematization	(3,5 hours, [1÷2]) C-TEP&IRC-01
2.	Methods for investigating the structure of inorganic compounds and materials	Lecture, explanation, conversation, description, problematization	(3,5 hours, [3÷4])
3.	Management of unconventional chemical synthesis methods	Lecture, explanation, conversation, description, problematization	(3,5 hours, [5]) C-TEP&IRC-11
4.	Standard operating procedures in chemistry. Basic concepts in statistics. Investigating the level of correlation between the data	Lecture, explanation, conversation, description, problematization	(3,5 hours, [6÷7]) C-TEP&IRC-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. J. L. Lalena, D. A. Cleary, E. E. Carpenter, N. F Dean, Inorganic Materials. Synthesis and fabrication, Wiley-Interscience, 2008.
4. D. W Bruce, D O'Hare, Inorganic Materials, John Wiley & Sons, 1997.
5. O. C. Kappe, A. Stadler. Microwaves in organic and medicinal chemistry, Wiley, Weinheim, Germany, **2005**.
6. Cecilia Arsene, Romeo Iulian Olariu, Metode analitico-statistice in investigarea sistemelor chimice, 241 p., ISBN: 978-973-730-606-7, PERFORMANTICA, Iasi, **2009**;
7. 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 promoting the discipline, the doctoral student will have the necessary knowledge to be able to select the optimal experimental technique to achieve the proposed research objective and will understand the meaning of some statistical terms necessary to properly process the experimental data obtained.

**10. Rating\***

Activity Type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in final grade (%)
10.4 Course	Correctness and completeness of knowledge as proof of the degree of correct understanding and application of the issues dealt with in the course. The degree of assimilation of the specialized language.	Colloquium – Lecture on a topic of research in the field of interest.	100
10.5 Seminar			
<b>10.6 Minimum Performance Standard</b>			
<ul style="list-style-type: none"> <li>▪ Knowledge of the meaning of the terms: discrete variables, random variables, probability distribution functions, mean, variance, sample size, sample distribution, sample parameters;</li> <li>▪ Ability to process experimental data using statistical procedures;</li> <li>▪ Knowledge of the ways to eliminate erroneous data through a statistical process.</li> </ul>			

Date of completion  
26.09.2024

Course holder  
Prof. univ. dr. Aurel PUI

Prof. univ. dr. Ionel MANGALAGIU

Prof. univ. dr. habil. Romeo Iulian OLARIU

Prof. univ. dr. habil. dr. Mihail Lucian BIRSA

Seminar holder

Date of approval

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