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 I**				
2.2 Course Activity Holder			**Prof. univ. dr. Ionel MANGALAGIU** **Prof. univ. dr. habil. Romeo Iulian OLARIU** **Prof. univ. dr. Aurel PUI**				
2.3 Owner of laboratory activities			**Prof. univ. dr. asoc. Elena BÎCU** **Prof. univ. dr. Gabi DROCHIOIU**				
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	**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

Professional skills	To conceive and carry out original research, based on advanced methods that lead to the development of scientific, technological knowledge and/or research methodologies. 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 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 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. Systematic, advanced knowledge of concepts, research methods, controversies and new hypotheses specific to the field; communication with specialists in related fields.
Transversal competence	Development of projects centered on creativity, as a basis for self-realization Assuming responsibility and capacity to organize and manage the activity of professional groups, scientific research or organizations/institutions Initiation and innovative development of complex theoretical and practical projects

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

7.1. General objective	The course aims to review the main modern experimental methodologies 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 correctly interpret them.
7.2. Specific objectives	Upon successful completion of this discipline, students will be able to: ▪ Know the management of methodologies, modern experimental techniques; ▪ understand the meaning of the terms: discrete and random variables, population, density probability, probability distribution functions, moments of a probability distribution function, mean and variance, sample size, sample distribution, sample parameters; ▪ process experimental data using statistical procedures; ▪ compares its own data with those in the specialized literature using statistical procedures; ▪ proposes algorithms for estimating the degrees of uncertainty of its own experimental data; ▪ know the degree of correctness of the data obtained; ▪ eliminate erroneous data using statistical procedures.

8. Content

8.1	**Course**	**Teaching methods***	**Observations** (hours and bibliographic references)
1.	Methodologies and techniques for preparing samples for analysis	Lecture, explanation, conversation, description, problematization	(1 hours, [1÷2]) C-CF&TAC-01
2.	Management of chromatographic analysis methods	Lecture, explanation, conversation, description, problematization	(1 hours, [1÷2]) C-CF&TAC-02
3.	Management of spectrometric analysis methods	Lecture, explanation, conversation, description, problematization	(1 hours, [1÷2]) C-CF&TAC-03
4.	Management of electrochemical methods of analysis	Lecture, explanation, conversation, description, problematization	(1 hours, [1÷2]) C-CF&TAC-04
5.	Advanced mass spectrometry methods	Lecture, explanation, conversation, description, problematization	(2 hours, [1÷2]) C-CF&TAC-05

6.	Problematization in the context of chemical analysis	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. Instrument in experimental data processing	Lecture, explanation, conversation, description, problematization	(2 hours, [3,4]) C-CF&TAC-08
9.	Methods and techniques for characterizing the analysis methods	Lecture, explanation, conversation, description, problematization	(2 hours, [3,4]) C-CF&TAC-09
10.	calibration management in chemical analysis	Lecture, explanation, conversation, description, problematization	(2 hours, [3,4]) C-CF&TAC-10
11.	Investigate the level of correlation between the data. Correlation coefficient	Lecture, explanation, conversation, description, problematization	(2 hours, [3,4]) C-CF&TAC-11
12.	Methodologies for estimating errors in chemical analyses	Lecture, explanation, conversation, description, problematization	(1 hours, [3,4]) C-CF&TAC-12
13.	The role of multiple variable analysis techniques	Lecture, explanation, conversation, description, problematization	(1 hours, [3,4]) C-CF&TAC-13
14.	Experience planning management and optimization procedures	Lecture, explanation, conversation, description, problematization	(1 hours, [3,4]) C-CF&TAC-14

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, Analytical-Statistical Methods in the Investigation of Chemical Systems, 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 and bibliographic references)
1.	Methodologies and techniques for preparing samples for analysis	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [1÷2]) S-CF&TAC-01
2.	Management of analytical instrumental 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 characterization of 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.	Methodologies for estimating errors in chemical analyses	Lecture, Explanation, Conversation, Description, Problematization	(1 hours, [3,4]) S-CF&TAC-06
7	Experience planning management and 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, Analytical-Statistical Methods in the Investigation of Chemical Systems, 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 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 of answers – understanding and correct application of the issues dealt with in the course.	Colloquium – Lecture on a modern experimental technique	75
10.5 Seminar	Correctness of answers – the correct acquisition and understanding of the issues dealt with at the seminar.	Lecture on a statistical technique used in the process of processing experimental data.	25
10.6 Minimum Performance Standard			

- Know the meaning of the terms: discrete variables, random variables, probability distribution functions, mean, variance, sample size, sample distribution, sample parameters;
- To process experimental data using statistical procedures;
- To know the degree of correctness of the data obtained;
- Know a way to eliminate erroneous data through a statistical process.

Date of completion	Course holder	Seminar Holder
26.09.2024	Prof. univ. dr. Ionel MANGALAGIU	Prof. univ. dr. Elena BÎCU
	Prof. univ. dr. habil. Romeo Iulian OLARIU	Prof. univ. dr. Gabi DROCHIOIU
	Prof. univ. dr. Aurel PUI	

Date of approval

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