COURSE DESCRIPTION

Chromatographic methods, optimization and validation

Academic year 2025-2026

1. Programme-related data

1.1. Higher Education Institution	Babeș-Bolyai University
1.2. Faculty	Faculty of Chemistry and Chemical Engineering
1.3. Department	Doctoral School of Chemistry
1.4. Field	Chemistry
1.5. Level of study	Doctorate
1.6. Degree programme / Qualification	Doctoral training / PhD in Chemistry
1.7. Form of education	

2. Course-related data

2.1. Course title	Chromatographic methods, optimization and validation			Course code	SDC-19-04
2.2. Course coordinator	Prof. Claudia Cimpoiu, Habil. PhD				
2.3. Seminar coordinator	Prof. Claudia Cimpoiu, Habil. PhD				
2.4. Year of study	I	2.5. Semester	II	2.6. Type of assessment	Exam
2.7. Course status	Optional			2.8. Course type	Specialisation subject

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

3.1. Number of hours per week	**3**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**1**
3.4. Total of hours in the curriculum	36	of which: 3.5. course	24	3.6. seminar/ laboratory	12
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					94
Additional research in the library, on subject-specific electronic platforms, and on-site					94
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					18
Tutoring (professional guidance)					8
Examinations					
Other activities					
3.7. Total hours of individual study (IS) and self-taught activities (ST)				**214**	
3.8. Total hours per semester				**250**	
3.9. Number of credits				**10**	

4. Prerequisites (where applicable)

4.1. curriculum-related	It is not necessary
4.2 skills-related	

5. Specific conditions (where applicable)

5.1. course-related	The courses and seminars take place in conditions of internet access and databases
5.2. seminar/laboratory-related	

6.1. Competencies resulting from the completion of the degree programme[1]

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes.

Professional competencies	
Competency code	**Competency**
PC1	Advanced expertise in chemistry and doctoral-level research topics
PC4	Planning, designing, and implementing an original scientific research project, in compliance with academic ethics and integrity
PC5	Applying and developing advanced research and analytical methods; critically interpreting data and formulating innovative solutions
Transversal competencies	
Competency code	**Competency**
TC2	Advanced scientific communication in Romanian and English; collaboration in interdisciplinary and multicultural settings
TC3	Advanced digital skills for research, data analysis, and dissemination; responsible use of digital tools.

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)[2]

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
PC1	Advanced and up-to-date knowledge in chemistry and the research field; critical understanding of the scientific literature.	Applies and synthesizes advanced concepts/theories to formulate research hypotheses; justifies the choice of scientific approaches.
PC4	Advanced research methodologies: experimental design, modern synthesis and characterization techniques, analysis and validation; principles of research project management.	Designs, plans and implements a research project; applies quality and safety procedures and documents stages and data with full traceability.
PC5	Advanced strategies for data analysis, interpretation, and integration; evaluation of methodological limitations, reproducibility, and scientific impact.	Critically analyses complex data, estimates uncertainty and formulates conclusions; proposes methodological improvements and directions for research/innovation.
TC2	Scientific terminology and communication in Romanian and English; the structure of scientific articles and presentations; good citation practices.	Writes and presents scientific results in Romanian/English coherently; provides well-argued responses to comments and peer reviews.
TC3	Digital tools for research, citation, and data processing (databases, specialized software, reference managers); responsible use of digital resources.	Uses discipline-specific digital tools effectively; manages citations; uses digital resources responsibly in research activities.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. Defining the notions, concepts, theories and models in the field of Chromatographic Methods, their optimization and validation, as well as their appropriate use in professional communication
2. Use of in-depth knowledge in the field of chemistry to explain and interpret processes specific to chromatographic methods, optimization and validation
3. Identification and application of advanced concepts, methods and theories for solving problems specific to chromatographic methods, optimization and validation
4. Critical analysis and use of advanced methods and techniques for quantitative and qualitative evaluation of the notions of chromatographic methods, optimization and validation

If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

5. Application of advanced concepts and theories in the field of Chromatographic Methods, optimization and validation for project development and problem solving
Specific academic skills
1. Ability to understand and interpret complementary data for the chromatographic analysis of various samples, to express and argue the interpretation of data based on the correlation of results and comparison with data from the literature
2. Execution of the requested tasks according to the specified requirements and within the imposed deadlines, in compliance with the norms of professional ethics and moral conduct, following a pre-established work plan
3. Solving the requested tasks in accordance with the general objectives established by integration within a working group
4. Ability to prepare written reports and to publicly support these reports

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks[3]**
8.1.1 Theoretical aspects of chromatographic methods	Lecture; Explication; Conversation; Description; Problems	
8.1.2 Theoretical aspects of chromatographic methods (continued)	Lecture; Explication; Conversation; Description; Problems	
8.1.3 Factors influencing chromatographic separation	Lecture; Explication; Conversation; Description; Problems	
8.1.4 Strategies for developing chromatographic methods	Lecture; Explication; Conversation; Description; Problems	
8.1.5 Optimization of stationary phase selectivity and selection of chromatographic columns	Lecture; Explication; Conversation; Description; Problems	
8.1.6 Optimization of mobile phase composition	Lecture; Explication; Conversation; Description; Problems	
8.1.7 Optimization of the pH of the mobile phase and of other working parameters	Lecture; Explication; Conversation; Description; Problems	
8.1.8 Chromatographic system optimization (column size, analysis time, sensitivity, etc.)	Lecture; Explication; Conversation; Description; Problems	
8.1.9 Computer aided methods used in the development and optimization of chromatographic methods	Lecture; Explication; Conversation; Description; Problems	
8.1.10 Validation of chromatographic methods - guides, regulations, quality standards and accreditation	Lecture; Explication; Conversation; Description; Problems	
8.1.11 Validation of chromatographic methods - parameters subject to validation	Lecture; Explication; Conversation; Description; Problems	
8.1.12 Validation of chromatographic methods - parameters subject to validation (continued)	Lecture; Explication; Conversation; Description; Problems	

Bibliography

1. "Principles of Instrumental Analysis", 7th ed. , 2017, Saunders College Publishing. ISBN 13:978-1-305- 57721, D. A. Skoog, F. James Holler, S. Crouch.
2. "Cromatografia de înaltă performanţă", vol. I-Cromatografia de gaze, Ed. Dacia, Cluj-Napoca, 1998, S. Gocan.
3. "Cromatografia de înaltă performanţă", vol. II-Cromatografia de lichide pe coloane, Ed. Risoprint, Cluj- Napoca, 2002, S. Gocan
4. "Cromatografia de înaltă performanţă", vol. I-Cromatografia pe strat subtire, Ed. Risoprint, Cluj- Napoca, 2005, S. Gocan
5. „Handbook of Analytical Validation", Ed. CRC Press, 2012, Michael E. Swartz, Ira S. Krull.
6. „Analytical Separation Science", 1st Edition, Ed. Wiley-VCH Verlag GmbH & Co. KGaA, 2015, Eds: Jared L. Anderson, Alain Berthod, Verónica Pino Estévez, and Apryll M. Stalcup.
7. „Validating chromatographic methods - a practical guide", Ed. John Wiley & Sons, New Jersey, 2006, D. M. Bliesner.

[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

8. „Principles and Practices of Method Validation", Ed. Royal Society of Chemistry, 2000, Eds: A. Fajgelj and A. Ambrus
9. Rad, R., Costea, L.M., Meghesan A., Cimpoiu C. LC- MS/MS analysis and validation of pesticides residue in vegetables asserted to be organic. *Journal of Liquid Chromatography and Related Technologies*, 2025.
10. Rad, R., Hosu, A., Cimpoiu, C. (2025). Matrix-matching calibration as a new approach for quantitation of monosodium glutamate in food seasoning powders using high performance thin layer chromatography. *Journal of Food Composition and Analysis*, 139, 107153.
11. Hosu A., Danciu V., Cimpoiu C. (2015). Validated HPTLC fingerprinting and antioxidant activity evaluation of twenty-seven Romanian red wines, *Journal of Food Composition and Analysis*, 41, 174-180.
12. Cimpoiu, C., (2003): Optimization. In: Handbook of Thin Layer Chromatography, Eds. Sherma, J. and Fried B. (New York: Marcel Dekker Press), 81-98.

8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
8.2.1-4. Development of a chromatographic method – practical case	Explanation; Conversation; Description; Problematization	4-hour seminars
8.2.5-8. Optimization of the previously developed chromatographic method	Explanation; Conversation; Description; Problematization	
8.2.9-12. Validation of the developed and optimized method	Explanation; Conversation; Description; Problematization	
Bibliography The collections from the last 5 years of the specialized journals: *JOAC, Analytical Chemistry, Jornal of Chromatography*, etc.		

9. Evaluation

Type of activity	9.1 Evaluation criteria[4]	9.2 Evaluation methods[5]	9.3 Percentage in the final grade
9.4. Course	Accuracy of answers – correct acquisition and understanding of the issues addressed Thinking style, rightness and argumentation of proposed solutions	Oral Exam	60%
9.5. Seminar/ laboratory	Activity carried out at the seminar	Presentation of papers on a given topic and answers to questions	40%
9.6 Minimum standard for passing			
Carrying out the obligatory activities			

10. SDG labels (Sustainable Development Goals)[6]

		Sustainable Development Generic Label

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

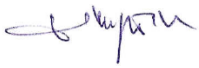
[5] Both final evaluation methods and ongoing evaluation strategies should be established.

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*

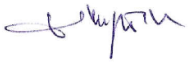
								
			X					
								No label applies

Date of entry:
2.02.2026

Signature of course coordinator



Signature of seminar coordinator



Date of approval in CDSC:

Signature of the Director of the DSC

Prof. dr. Niculina Daniela Hădade

