**Course Syllabus**

**1. Data about the program**

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| 1.1 Higher education institution | Babeș-Bolyai University |
| 1.2 Faculty | Faculty of Chemistry and Chemical Engineering |
| 1.3 Doctoral school | Chemistry |
| 1.4 Field of study | Chemistry |
| 1.5 Study cycle | Doctorate |
| 1.6 Study program / Qualification | Doctoral training / PhD in Chemistry |

**2. Course data**

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| 2.1 Name of discipline | | | **Chromatographic methods, optimization and validation - SDC-19-04** | | | | | | |
| 2.2 Teacher responsible for lectures | | | | | Prof. Claudia Cimpoiu, PhD | | | | |
| 2.3 Teacher responsible for seminars | | | | | Prof. Claudia Cimpoiu, PhD | | | | |
| 2.4 Year of study | I | 2.5 Semester | | II | | 2.6. Type of evaluation | E | 2.7 Course framework | Op |

**3. Estimated total time of teaching activities** (hours per semester)

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| 3.1 Hours per week | 2 | | Out of which: 3.2 Lectures | | 1 | 3.3 Seminars / Laboratory classes | 1 |
| 3.4 Total hours in the curriculum | 24 | | Out of which: 3.5 Lectures | | 12 | 3.6 Seminars / Laboratory classes | 12 |
| Allocation of study time: | | | | | | | hour |
| Study supported by textbooks, other course materials, recommended bibliography and personal student notes | | | | | | | 100 |
| Additional learning activities in the library, on specialized online platforms and in the field | | | | | | | 100 |
| Preparation of seminars / laboratory classes, topics, papers, portfolios and essays | | | | | | | 18 |
| Tutoring | | | | | | | 8 |
| Examinations | | | | | | |  |
| Other activities: - | | | | | | | - |
| 3.7 Individual study (total hours) | | 226 | |
| 3.8 Total hours per semester | | 250 | |
| 3.9 Number of credits | | 10 | |

**4. Preconditions** (where applicable)

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| 4.1 Curriculum | * It is not necessary |
| 4.2 Competences | * It is not necessary |

**5. Conditions** (where applicable)

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| 5.1 Conducting lectures | * The courses take place in conditions of internet access and databases |
| 5.2 Conducting seminars / laboratory classes | * The seminars take place in conditions of internet access and databases |

**6. Specific competences acquired**

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| **Professional competences** | * 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 * Use of in-depth knowledge in the field of chemistry to explain and interpret processes specific to chromatographic methods, optimization and validation * Identification and application of advanced concepts, methods and theories for solving problems specific to chromatographic methods, optimization and validation * Critical analysis and use of advanced methods and techniques for quantitative and qualitative evaluation of the notions of chromatographic methods, optimization and validation * Application of advanced concepts and theories in the field of Chromatographic Methods, optimization and validation for project development and problem solving * 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 |
| **Transversal competences** | * 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 * Solving the requested tasks in accordance with the general objectives established by integration within a working group * Permanent information and documentation in its field of activity in Romanian * Concern for improving the results of professional activity by getting involved in the activities carried out * Ability to prepare written reports and to publicly support these reports |

**7. Course objectives** (based on the acquired competencies grid)

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| 7.1 The general objective of the course | * Acquisition of notions regarding the structural characterization of materials and precursors using specific techniques |
| 7.2 Specific objectives | * Acquisition of basic theoretical knowledge on chromatographic methods, optimization and validation. Develop problem-solving skills. |

**8. Content**

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| 8.1 Lectures | Teaching methods | Comments |
| 8.1.1 Theoretical aspects of chromatographic methods | Lecture; Explication; Conversation; Description; Problems | Courses lasting 1 hour / week |
| 8.1.2 Theoretical aspects of chromatographic methods (continued) |
| 8.1.3 Factors influencing chromatographic separation |
| 8.1.4 Strategies for developing chromatographic methods |  |  |
| 8.1.5 Optimization of stationary phase selectivity and selection of chromatographic columns |  |  |
| 8.1.6 Optimization of mobile phase composition |  |  |
| 8.1.7 Optimization of the pH of the mobile phase and of other working parameters |  |  |
| 8.1.8 Chromatographic system optimization (column size, analysis time, sensitivity, etc.) |  |  |
| 8.1.9 Computer aided methods used in the development and optimization of chromatographic methods |  |  |
| 8.1.10 Validation of chromatographic methods - guides, regulations, quality standards and accreditation |  |  |
| 8.1.11 Validation of chromatographic methods - parameters subject to validation |  |  |
| 8.1.12 Validation of chromatographic methods - parameters subject to validation (continued) |  |  |
| Bibliography:   1. 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. 2. “Cromatografia de înaltă performanţă”, vol. I-Cromatografia de gaze, Ed. Dacia, Cluj-Napoca, 1998, S. Gocan. 3. 3. “Cromatografia de înaltă performanţă”, vol. II-Cromatografia de lichide pe coloane, Ed. Risoprint, Cluj- Napoca, 2002, S. Gocan 4. 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.  8. „Principles and Practices of Method Validation”, Ed. Royal Society of Chemistry, 2000, Eds: A. Fajgelj and A. Ambrus | | |
| 8.2 Seminars / laboratory classes | Teaching methods | Comments |
| Case studies prepared with the doctoral students, based on their individual doctoral research topics | Presentation, discussion, exercises | Seminar lasting 1 hour / week |
| Bibliography:  The collections from the last 5 years of the specialized journals: JOAC, Analytical Chemistry, Jornal of Chromatography, etc. | | |

**9. Aligning the contents of the discipline with the expectations of the epistemic community representatives, professional associations and standard employers operating in the program field**

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| * By mastering the theoretical-methodological concepts and approaching the practical aspects included in the discipline Chromatographic methods, optimization and validation, PhD students acquire a consistent knowledge, in accordance with the partial skills required for possible occupations provided in Grid 1 - RNCIS. |

**10. Examination**

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| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Weight in the final grade |
| 10.4 Lectures | Assessment of knowledge | Oral exam | 40% |
| Assessment of knowledge | Ongoing tests | 20% |
| 10.5 Seminars / laboratory classes | Activity during seminars | Discussions, answers to questions | 10% |
| Assessment of knowledge | Presentation of articles | 30% |
| 10.6 Minimum performance standard | | | |
| * Carrying out the obligatory activities | | | |

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| Date of issue  14.10.2021 | Signature of the teacher responsible for lectures | Signature of the teacher responsible for seminars |

Date of approval by the doctoral school council Signature of the doctoral school director