COURSE DESCRIPTION

Advanced Stereochemistry

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	Babeș-Bolyai University, Cluj-Napoca
1.2. Faculty	Faculty of Chemistry and Chemical Engineering
1.3. Department	Chemistry
1.4. Field	Chemistry
1.5. Level of study	Master's degree
1.6. Degree programme / Qualification	Organic and Biochemical Processes Engineering / Chemical Engineer
1.7. Form of education	Full-time

2. Course-related data

2.1. Course title	**Advanced Stereochemistry**			Course code	**CMR1748**
2.2. Course coordinator	Prof. Dr. Niculina Hădade				
2.3. Seminar coordinator	Prof. Dr. Niculina Hădade				
2.4. Year of study	II	2.5. Semester	1	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	**4**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**2**
3.4. Total of hours in the curriculum	56	of which: 3.5. course	28	3.6. seminar/ laboratory	**28**
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					20
Additional research in the library, on subject-specific electronic platforms, and on-site					20
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					16
Tutoring (professional guidance)					5
Examinations					4
Other activities					4
3.7. Total hours of individual study (IS) and self-taught activities (ST)				**69**	
3.8. Total hours per semester				**125**	
3.9. Number of credits				**5**	

4. Prerequisites (where applicable)

4.1. curriculum-related	
4.2 skills-related	

5. Specific conditions (where applicable)

5.1. course-related	
5.2. seminar/laboratory-related	

6.1. Competencies resulting from the completion of the degree programme *(as referred to in the curriculum)*[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	Description, analysis and use of fundamental concepts and theories in the field of organic chemistry, biochemistry, microbiology, genetics and molecular biology.
PC4	The operation of installations and processes in the field of organic and biochemical processes.
PC5	Modeling biological systems/bioengineering structures and processes of fine organic synthesis.
Transversal competencies	
Competency code	**Competency**
TC2	Planning, monitoring, and assuming the duties of a subordinate professional group. Demonstrating the capacity of coordination, analytical thinking, adaptability and flexibility, collaboration with team members.
TC3	Self-assessment of professional performances and determining the continuous training needs, permanent information and documentation in the field of activity and related areas, according to the needs of the labour market.

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**
CP2, CP4, CP5	The student/graduate knows effective ecological synthesis methods.	The student/graduate proposes sustainable (bio)technologies for synthesis and implements them (partially) experimentally.
CP2, CP4, CP5, CP6	The student/graduate knows the operations and equipment used in organic processes and bioprocesses involved in obtaining and developing useful products.	The student/graduate develops operational schemes and tools for obtaining useful products (pharmaceuticals, food products, other synthetic compounds), performs equipment calculations and modeling/optimization.
CP2, CP4, CP5, CP6	The student/graduate knows the basic principles of a (bio)process, the stages of technology development, and methods for separating useful products.	The student/graduate proposes technologies for obtaining useful products, including their separation/purification steps.
CP3, CP4, CP5, CP6	The student/graduate knows and specifically applies methods for analyzing and controlling the quality of raw materials, intermediates, and useful products of a (bio)process.	The student/graduate performs the analysis and determines the quality of raw materials, intermediates, and useful products of a (bio)process using appropriate methods.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. Explains the fundamental concepts of advanced stereochemistry, including symmetry operations, point groups, chirality, enantiomerism, diastereomerism, and prochirality.
2. Describes the different types of chirality (central, axial, planar, helical, topological, and supramolecular) and the descriptors and experimental methods used for stereochemical configuration assignment.
3. Explains the principles of conformational analysis of acyclic, cyclic, and saturated heterocyclic compounds, including the interactions that govern conformational equilibria and the methods used to determine conformational free enthalpies.
4. Understands the relationship between molecular structure, stereogenic elements, and stereochemical behaviour in compounds with one or multiple stereogenic elements, including geometric diastereomerism.

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.

Specific academic skills
1. Analyses and assigns the stereochemical structure and configuration of organic compounds using symmetry considerations, stereochemical descriptors, molecular models, and relevant experimental data.
2. Evaluates conformational preferences and stereochemical relationships in acyclic and cyclic systems, using appropriate models and theoretical arguments to justify the proposed solutions.
3. Communicates clearly and supports, orally and in writing, solutions to stereochemical problems, while using the specialized literature appropriately and collaborating effectively in seminar and laboratory activities.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks[3]**
8.1.1. General notions.	Lecture; Explanation; Discussion	2 hours
8.1.2. Symmetry operations, point symmetry groups.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.3. Enantiomerism: optical activity, configuration descriptors.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.4. Chirality: central, axial, planar, helical.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.5. Topological and supramolecular chirality.	Lecture; Explanation; Discussion; Problem-based learning	2 hours
8.1.6. Prochirality.	Lecture; Explanation; Discussion; Problem-based learning	2 hours
8.1.7. Experimental methods for determining configurations.	Lecture; Explanation; Discussion; Problem-based learning	2 hours
8.1.8. Diastereomerism. General aspects.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.9. Conformational analysis. Types of interactions.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.10. Methods for determining conformational free enthalpies.	Lecture; Explanation; Discussion; Problem-based learning	2 hours
8.1.11. Conformational analysis of acyclic compounds.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.12. sp2-sp3, sp2-sp2, and sp-sp torsions.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.13. Conformational analysis of cycloalkanes and saturated heterocyclic compounds.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
8.1.14. Geometric diastereomerism and diastereomerism of compounds with multiple stereogenic elements.	Lecture; Explanation; Discussion; Molecular models; Problem-based learning	2 hours
Bibliography		
S. Mager, I. Grosu, L. David, Stereochimia Compușilor Organici, Dacia Publishing House, 2006. E. L. Eliel, S. Wilen, Sterochemistry of Organic Compounds, Wiley, 1994. S. Sen Gupta, Basic Stereochemistry of Organic Molecules, 2nd edition, Oxford University Press, 2018. J. March, B. Smith, Advanced Organic Chemistry, Wiley, 2006. M. Avram, Organic Chemistry, Vol. 1, 2nd edition, Zecasin Publishing House, Bucharest, 1999. Course materials.		

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

8.2. Seminar/ laboratory	Teaching and learning methods	Remarks
8.2.1. Stereochemical formulas.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.2. Symmetry operations, point symmetry groups.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.3. Enantiomerism: optical activity, configuration descriptors.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.4. Chirality: central, axial, planar, helical.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.5. Topological and supramolecular chirality.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.6. Prochirality.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.7. Methods for determining configurations.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.8. Diastereomerism.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.9. Conformational analysis. Types of interactions.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.10. Methods for determining conformational free enthalpies.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.11. Conformational analysis of acyclic compounds.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.12. sp2-sp3, sp2-sp2, and sp-sp torsions.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.13. Conformational analysis of cyclic compounds.	Explanation; Discussion; Description; Problem-based learning	2 hours
8.2.14. Geometric diastereomerism and diastereomerism of compounds with multiple stereogenic elements.	Explanation; Discussion; Description; Problem-based learning	2 hours
Bibliography: S. Mager, I. Grosu, L. David, Stereochimia Compușilor Organici, Dacia Publishing House, 2006. E. L. Eliel, S. Wilen, Sterochemistry of Organic Compounds, Wiley, 1994. S. Sen Gupta, Basic Stereochemistry of Organic Molecules, 2nd edition, Oxford University Press, 2018. J. March, B. Smith, Advanced Organic Chemistry, Wiley, 2006.		

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	Correctness of answers – proper acquisition and accurate understanding of the topics covered.	Oral examination – access to the examination is conditional upon submission of the seminar papers. Examination fraud is sanctioned by expulsion in accordance with the UBB ECTS Regulations.	60 %
	Way of thinking, correctness, and justification of the proposed solutions.		
9.5. Seminar/ laboratory	Activity carried out during the seminar and submission of the seminar papers.	The papers must be submitted no later than the last week of teaching activity.	40%
	Quality of the paper and correct use of specialized literature.		
9.6 Minimum standard for passing			
Obtaining grade 5 (five) in the examination.			

[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.

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

	○	Sustainable Development Generic Label

								
○	○	○	X	○	○	○	○	○
								No label applies
○	○	○	○	○	○	○	○	○

Date of entry:
17.04.2026

Signature of course coordinator

Prof. Dr. Niculina Hădade

Signature of seminar coordinator

Prof. Dr. Niculina Hădade

Date of approval in the department:
24.04.2026

Signature of the head of department

Prof. Dr. Monica Toșa

[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."*