R O M Â N I A
MINISTERUL EDUCAȚIEI ȘI CERCETĂRII
Universitatea din Craiova
FACULTATEA DE ȘTIINȚE/ DEPARTAMENTUL DE CHIMIE
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Subject Description

1. Program information

1.1. Institution	University of Craiova
1.2. Faculty	Science
1.3. Department	Chemistry
1.4. Study field	Chemistry
1.5. Study level	Master
1.6. Type of education	full-time
1.7. Study program	Advanced Chemistry

2. Subject information

2.1. Subject			**Advanced organic chemistry**				
2.2. Course coordinator			Prof.dr. George Brătulescu				
2.3. Application coordinator			Prof.dr. George Brătulescu				
2.4. Year of study	II	2.5. Semester	3	2.6. Type of evaluation	E	2.7. Subject type	DS/DOB

3. Total estimated type (hours/semester)

3.1. Number of hours per week	4	from which: 3.2 course	2	3.3. seminar/lab	2
3.4. Total hours in curriculum	56	from which: 3.5 course	28	3.6. seminar/lab	28
Time allocation – hours/week					
Study using textbooks, course materials, bibliographies, and notes					40
Additional documentation in the library, on specialized electronic platforms, and in the field					30
Preparation of seminars/labs, assignments, reports, portfolios, and essays					15
Tutoring					5
Examinations					4
Other activities.....					
3.7. Total hours of individual study					94
3.8. Total hours per semester					150
3.9. Number of ECTS					6

4. Preconditions (if the case)

4.1. of curriculum	• To master the discipline, concepts of organic and organometallic chemistry, structure, catalysis, and reaction mechanisms are used.
4.2. of competences	•

5. Conditions (if the case)

5.1. for course	• Classroom. Minimum four students.
5.2. for labs	• Attendance at all laboratory work is mandatory for all students (they must be made up in case of any absences)

6. Course objectives - expected learning outcomes achieved by completing and passing the course

Knowledge	- Description, analysis, and use of advanced chemistry concepts for deepening knowledge in the field of organic synthesis. - Account of a powerful problem-solving strategy in organic synthesis, in which one works backwards from a complex target molecule to identify accessible starting reactants, chemical reactions, catalysts, reaction mechanisms, and conditions. - Analysis and communication of scientific information in the area of retrosynthesis. - Identifying and defining objectives related to synthesis and retrosynthesis, as well as developing a plan for achieving the proposed objectives (target molecules, synthons, intermediates, synthesis trees).
Skills	- Involvement in the activities carried out by a subordinate professional group through coordination, monitoring, and evaluation actions. - Practicing a work method acquired through independent study in order to fulfill professional tasks, acting in accordance with professional ethics and standards of moral conduct. - Developing a personal system of continuous information and documentation, both in one's own field of activity and in related fields, taking into account labor market trends.
Responsibility and autonomy	- Students establish the strategy for building complex molecules through the process of organic retrosynthesis. - Students identify key bonds (strategic bonds) in the target molecule. - Students perform the disconnection of the target organic molecule into synthons and identify homologues of the synthons in synthetic equivalent and real molecules. - Students develop efficient pathways to create new compounds using known organic reactions and reaction mechanisms. - Students streamline synthetic procedures.

7. Table of contents

7.1. COURSE	Mode of operation	Teaching methods	Allocated time (hours)
1. General aspects. Target molecule. Retrosynthetic analysis. Cleavage or disconnection. Retron. Logical and illogical synthons. Synthetic equivalent.	On site (week 1)	The lecture and interactive presentation, heuristic conversation, problem-based learning.	4
2. Identifying the strategic bonds of target molecules: cleavage next to a functional group; symmetry and disconnection; chain and ring disconnection; heteroatom-level disconnection.	On site (week 3)	The lecture and interactive presentation, heuristic conversation, problem-based learning.	2
3. Recognition of functional equivalences. Activation and protection. Defunctionalization. Stereochemistry.	On site (week 3)	The lecture and interactive presentation, heuristic conversation, problem-based learning.	3
4. Monofunctional synthons: Heteroatomic disconnection-monovalent functions through functional interconversion, reduction and oxidation; syntheses of alkanes, amines, alkenes, alkynes; trivalent functions through functional interconversion.	On site (week 3,5)	The lecture and interactive presentation, heuristic conversation, problem-based learning.	3
5. Disconnection in the aromatic series. Double heteroatomic disconnection. Carbon–carbon disconnection.	On site (week 7)		4
4. Multiple synthons: Breaking	On site	The lecture and interactive	4

strategic 1–2 bonds. Breaking strategic 1–3 bonds. Breaking strategic 1–4 bonds. Breaking strategic 1–5 bonds. Breaking strategic 1–6 bonds.	(week 9)	presentation, heuristic conversation, problem-based learning.	
5. Cycle syntheses: Three-membered rings. Four-membered rings. Five-membered rings. Six-membered rings. Heterocycles.	On site (week 11)	The lecture and interactive presentation, heuristic conversation, problem-based learning.	4
6. Selectivity: Chemoselectivity. Regioselectivity. Diastereoselectivity. Enantioselectivity.	On site (week 13)	The lecture and interactive presentation, heuristic conversation, problem-based learning.	4
References:			
1. G. Brătulescu, ” Retrosinteza și sinteza organică ”, curs multiplicat, Ed. Olemex Serv., Craiova, 2017. 2. M. B. Smith, ” March's advanced organic chemistry: Reactions, mechanisms, and structure ”, 8th Ed., Wiley, 2020. 3. V. Sunjic, V.P. Perokovic, ” Organic chemistry from retrosynthesis to asymmetric synthesis ”, Springer, 2016 4. P. P. Santos, ”Retrosynthesis in the manufacture of generic drugs”, John Wiley & Sons Ltd, 2021 5. G. Brătulescu, ’’Probleme și teste de chimie organică, organometalică și biochimie’’, Ed. Sitech, Craiova, 2025. 6. G. Brătulescu, ’’Chimie organică. Funcțiuni’’, Ed. Alma, Craiova, 2023.			

7.2. Lab	Mode of operation	Teaching methods	Allocated time (hours)
L1. Specific labor safety and fire prevention regulations in the laboratory of advanced organic chemistry	On site (week 2)	Explanation, discussion, debate, and questioning	4
L2. Preparation of 2-(4-chlorophenyl)-3,4-dihydroimidazo [4,5-b]indole	On site (week 4)	Experiment, explanation, discussion, debate, and questioning	4
L3. Preparation of 9-phenylacridine	On site (week 6)	Experiment, explanation, discussion, debate, and questioning	4
L4. Syntheses of *α*-amidoalkyl-*β*-naphthols under solid-state conditions	On site (week 8)	Experiment, explanation, discussion, debate, and questioning	4
L5. Synthesis of 3-(phenylimino)-2,3-dihydro-1*H*-indol-2-one	On site (week 10)	Experiment, explanation, discussion, debate, and questioning	4
L6. Recovery session	On site (week 12)	Experiment, explanation, discussion, debate, and questioning	4
L7. Laboratory colloquium	On site (week 14)	Experiment, explanation, discussion, debate, and questioning	4

8. Correlation of the discipline content with the expectations of representatives of the epistemic community, professional associations, and representative employers in the field related to the program

The course presents a modern, up-to-date strategy essential for chemists, biochemists, and pharmacists for the construction of synthetic or natural organic molecules (target molecules), by identifying synthons, synthetic equivalents, and precursors. After the retrosynthetic analysis, the target molecule is obtained using known reactions and methods, and the conditions and mechanisms are discussed. This approach prepares master's students to independently solve synthetic problems and to develop proposals for the synthesis of complex organic molecular structures.

9. Evaluation

Activity	9.1. Evaluation criteria	9.2. Evaluation method	9.3. Contribution to final score
9.4. Course	Knowledge and assimilation of specialized informational content. Accuracy of knowledge, logical coherence, clear expression.	Written Exam	70%
9.5. Lab	Completion of laboratory work and correct interpretation of data, accompanied by the preparation of a portfolio with reports. Carrying out laboratory experiments and interpreting their results.	Laboratory colloquium	30%
9.6. Minimum performance standard			
• Preparation of an extensive bibliographic study using relevant and up-to-date documentation sources. • Development of a complete experimental protocol for characterization and analysis. • Execution of complex professional tasks in compliance with professional ethics and moral conduct, following a personal work plan established on the basis of independent study. • Development of an appropriate documentation/application plan.			

Date
22.09.2025

Course coordinator,
Prof. dr. George Brătulescu

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Date of approval
25.09.2025

Head of Department,
Conf.dr. Nicoleta Cioateră