COURSE DESCRIPTION

Green Chemistry-aspecte teoretice si tehnologice
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	Chemical Engineering
1.4. Field	Chemical Engineering
1.5. Level of study	Master
1.6. Degree programme / Qualification	ADVANCED PROCESS CHEMICAL ENGINEERING
1.7. Form of education	Full-time education

2. Course-related data

2.1. Course title	*Green Chemistry-aspecte teoretice si tehnologice*			Course code	**CME7141**
2.2. Course coordinator	Gaina Luiza				
2.3. Seminar coordinator	Gaina Luiza				
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	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)					14
Additional research in the library, on subject-specific electronic platforms, and on-site					21
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					28
Tutoring (professional guidance)					2
Examinations					2
Other activities					2
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	General Chemistry and Organic Chemistry
4.2 skills-related	No

5. Specific conditions (where applicable)

5.1. course-related	**Interactive participation** Students must keep their mobile phones switched off during lectures. Part of the course activities may be conducted in **synchronous online format**, in accordance with **UBB/FCIC regulations** and depending on the decision of the course coordinator. These aspects will be communicated to students within the first two weeks from the beginning of the semester. **Recording of online classes by students is not permitted.**

5.2. seminar/laboratory-related	**Interactive participation** Students must keep their mobile phones switched off during seminars.

6.1. Competencies resulting from the completion of the degree programme *(as referred to in the curriculum)*[1]

Professional competencies	
Competency code	**Competency**
PC2	*Technological design of processes, equipment and apparata specific to process engineering for the improvement of performances of biochemical and chemical processes by using computer-assisted instruments (CAD) and principles of longterm development.*
Transversal competencies	
Competency code	**Competency**
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**
PC6, PT2	1. Knowledge of advanced concepts for analysis, intensification and synthesis of processes, devices and equipment specific to process engineering	1. Creative use of the analysis, intensification and synthesis of chemical processes in the development of innovative products/technologies and in the improvement of the decision-making act related to their optimal management

7. Subject-specific learning outcomes

Knowledge and comprehension
The student knows the principles of "green chemistry", understands specific concepts such as the life cycle analysis of chemical synthesis products, describes methods for waste reduction, the use of catalytic processes, raw materials from renewable sources, and alternative energy sources in the chemical industry. The student knows and understands the risk factors in the chemical industry, the toxicity and biodegradability of organic synthesis compounds. The student knows and uses the appropriate methods of information / documentation / knowledge acquisition necessary for understanding sustainable development.
Specific academic skills

[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. 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.

The student applies the concepts of green chemistry in the detailed interpretation of the characteristics of fine organic chemical synthesis processes. The student applies effective strategies for documentation and searching for scientific information and critically evaluates the scientific literature; formulates reasoning/arguments supported by scientific evidence and communicates them clearly in a variety of formats (models, tables, graphs, mathematical equations, etc., as appropriate). The student systematically applies scientific strategies and methods to describe, compare, and analyse industrial synthesis processes. The student proposes technological solutions based on the principles of green chemistry and sustainable development in a clear and concise manner, both for chemists and non-chemists, in accordance with professional standards.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks[3]**
Principles of Green Chemistry, definition and specific concepts	**Lecture Debate**	
Life cycle assessment of chemical products		
Prevention of waste formation in chemical industry (/Reduce/Recycle//Recover)		
Atom economy (inherently atom economic reactions)		
Risk factors: toxicity of chemical products and intermediates.		
Design of safer chemical compounds: biodegradable chemical products		
Solvents and auxiliaries in industrial chemical processes.		
Catalytical processes in chemical industry.		
Renewable resources for the chemical industry		
Alternative energy sources for chemical processes.		
Analytical methods for real time analysis and pollution control.		
Processes intensification; modern industrial equipment for unit operations		
Reduce/elimination of hazards in chemical industry		
Progress and limitations in the design of chemical processes (case studies)		
Bibliography: pdf copy of PPT presentation 1. P. T. Anastas, J. C. Warner "*Green Chemistry Theory and Practice*" Oxford Univ. Press, 1998. 2. M. Lancaster "*Green Chemistry an introductory text*" Pub. The Royal Society of Chemistry, 2002 3. P. Tundo, A. Perosa, F. Zechinni, *Methods and Reagents for Green Chemistry*" J. Wiley and Sons, 2007. 4. W. M. Nelson, *Green solvents for chemistry: perspectives and practice,* Oxford Univ. Press, 2003. 5. M. Doble, A. K. Kruthiventi *Green Chemistry &Engineering,* Elsevier Sci & Technol. Books, 2007.		
8.2. Seminar	**Teaching and learning methods**	**Remarks**
Life Cycle Assessment (LCA) of polyethyleneterephthalate (PET bottles)	Report, Presentation, Debate, Collaborating	
Life cycle analysis of detergents		
Life cycle analysis of lacquers and paints		
Application of green chemistry principles in industrial processes for polymer production		

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

Application of green chemistry principles in industrial processes for the production of volatile oils		
Application of green chemistry principles in industrial processes for glycerin production		
Application of green chemistry principles in industrial processes for the production of alpha-hydroxy acids (AHAs)		
Application of green chemistry principles in industrial processes for wax production (lanolin)		
Application of green chemistry principles in industrial processes for the production of disinfectants		
Application of green chemistry principles in industrial processes for vitamin manufacturing		
Application of green chemistry principles in industrial processes for ethanol production		
Application of green chemistry principles in antibiotic production		
Application of green chemistry principles in bacteriostatic agent production		
Application of green chemistry principles in acetic acid production		
Bibliography: Ullmann's Encyclopedia of Industrial Chemistry, Wiley-VCH Verlag GmbH & Co. KGaA.		

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	Knowledge of green chemistry concepts Development of skills in using green chemistry concepts in the analysis of industrial processes for the production of consumer goods	**Written paper** in which the application of the principles of green chemistry in a manufacturing process of a chemical synthesis compound is analyzed *in extenso* **Oral presentation** with **PPT support** on the same topic **Answers to questions** formulated by the examiner	45% 20% 20%
	Understanding and assimilation of the topics covered in lectures and seminars Ability to appropriately use concepts and methods	Completion of assignments during the semester / mandatory presentation of papers	15%
9.5. Seminar/ laboratory			
9.6 Minimum standard for passing			

[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						
1 FĂRĂ SĂRĂCIE	2 FOAMETE „ZERO”	3 SĂNĂTATE ȘI BUNĂSTARE	4 EDUCAȚIE DE CALITATE	5 EGALITATE DE GEN	6 APĂ CURATĂ ȘI SANITAȚIE	7 ENERGIE CURATĂ ȘI LA PREȚURI ACCESIBILE	8 MUNCĂ DECENTĂ ȘI CREȘTERE ECONOMICĂ	9 INDUSTRIE, INOVAȚIE ȘI INFRASTRUCTURĂ
○	○	○	○	○	○	○	○	○
10 INEGALITĂȚI REDUSE	11 ORAȘE ȘI COMUNITĂȚI DURABILE	12 CONSUM ȘI PRODUCȚIE RESPONSABILE	13 ACȚIUNE CLIMATICĂ	14 VIAȚA ACVATICĂ	15 VIAȚA TERESTRĂ	16 PACE, JUSTIȚIE ȘI INSTITUȚII EFICIENTE	17 PARTENERIATE PENTRU REALIZAREA OBIECTIVELOR	No label applies
○	○	◉	○	○	○	○	○	○

Date of entry:
17.04.2026

Signature of course coordinator

Gaina Luiza

Signature of seminar coordinator

Gaina Luiza

Date of approval in the department:
.24.04.2026

Signature of the head of department

Prof. Dr. Ing. 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.”*