COURSE DESCRIPTION

Design of Electrochemical reactors

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	Babeș-Bolyai University, Cluj Napoca
1.2. Faculty	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/ Master's Degree
1.7. Form of education	Full-time education

2. Course-related data

2.1. Course title	**Design of Electrochemical reactors**			Course code	**CME7344**
2.2. Course coordinator	Associate Professor Dr. Eng. Adrian NICOARĂ				
2.3. Seminar coordinator	Associate Professor Dr. Eng. Adrian NICOARĂ				
2.4. Year of study	II	2.5. Semester	3	2.6. Type of assessment	Viva voce
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	126	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)					21
Additional research in the library, on subject-specific electronic platforms, and on-site					18
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					21
Tutoring (professional guidance)					6
Examinations					3
Other activities					
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	Not the case
4.2 skills-related	Not the case

5. Specific conditions (where applicable)

5.1. course-related	• The students will switch off the mobile phones • Delays will not be tolerated
5.2. seminar/laboratory-related	• The students will switch off the mobile phones • Delays will be penalised with 0.5 points/day

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

Professional competencies	
Competency code	**Competency**
PC1	Description, analysis and use of elaborate theories and concepts in the fields of chemistry and process advanced chemical engineering.
PC4	Development of processes, apparatus and equipment specific to process engineering by promoting new solutions for process intensification, optimum operation and control.
Transversal competencies	
Competency code	**Competency**
TC1	Independent execution of complex professional assignments and autonomous development of project-research activities by using computer-assisted techniques and by observing the norms of professional ethics and moral conduct.

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**
CP1 **CP4** **CT1**	1. Formulation of solutions to solve complex chemical engineering problems based on knowledge, identification and application of advanced concepts, methods and theories in the field of chemical engineering and chemistry	*1. Critical analysis and application of advanced principles, methods, and techniques for the evaluation, design, and development of new products and technologies.*

7. Subject-specific learning outcomes

Knowledge and comprehension
1. Define detailed notions, concepts, theories and models in the field of electrochemical engineering
2. Use in-depth knowledge in the field of electrochemical engineering to explain and interpret electrode processes
3. Identify and apply advanced concepts, methods and theories to solve complex problems in the field of electrochemical engineering
4. Use appropriate qualitative and quantitative methods in the design of electrochemical reactors to ensure advanced management
Specific academic skills
1. Critical analysis and use of advanced principles and methods of work for qualitative and quantitative evaluations in electrochemical engineering
2. Evaluation and critical analysis of processes in the electrochemical industry for the development of concepts, theories and adequate design methods
3. Specific resource management and quality assurance in industries involving electrochemical processes development of non-polluting technologies with minimal energy consumption in the context of sustainable development

[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.

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. Basic concept in electrochemical reactor design	Presentation; Explanation, Conversation; Description; Debate; Powerpoint presentation	
8.1.2. Specific aspects of electrochemical reactor		
8.1.3. Mass transport in electrochemical reactor		
8.1.4. Energy balances in electrochemical reactor		
8.1.5. The rate of the electrochemical processes		
8.1.6. Electrochemical reactor (ER) Models (I). Discontinuous ER		
8.1.7. Electrochemical reactor Models (II). Displacement ER		
8.1.8 Electrochemical reactor Models (III). Perfect mixture ER		
8.1.9. ER design (I). ER active surface design		
8.1.10. ER design (II). ER electric and hydraulic connections		
8.1.11. ER design (III). Evaluation of ER performance parameters (current and voltage yield, specific energy consumption, specific chemical yield)		
8.1.12. Optimisation of ER performance		
8.1.13. Modelling of ER		
8.1.14. Economic performances evaluation of ER		

Bibliography

1. A. Nicoara, Lecture support, updated annualy, Available on-line
2. F. Goodridge, K. Scott, Electrochemical process engineering: A Guide to the design of electrolytic plant, Plenum, New York, London, 1995.
3. L. Oniciu, P. Ilea, Ionel Cătalin Popescu, „Electrochimie tehnologică", Casa Cărţii de Ştiinţă, Cluj-Napoca, 1995.

8.2 Seminar	Teaching methods	Remarks
8.2.1. Summary of basic electrochemistry concepts	Presentation; Explanation Conversation; Description; Debate	
8.2.2. Energy balance in the ER		
8.2.3. Mass transport, electrochemical reactions rate		
8.2.4. Reaction models.		
8.2.5. ER Models: discontinuous ER		
8.2.6. ER Models: continuous ER		
8.2.7. Economic performances evaluation, electrochemical processes modelling and optimization		

Bibliography

1. F. Goodridge, K. Scott, Electrochemical process engineering: A Guide to the design of electrolytic plant, Plenum, New York, London, 1995.

8.3 Project	Teaching methods	Remarks
Designing of an electrochemical reactor for a specific electrochemical process.	Presentation; Explanation Conversation; Description; Debate	

Bibliography

1. F. Goodridge, K. Scott, Electrochemical process engineering: A Guide to the design of electrolytic plant, Plenum, New York, London, 1995.

2. J. Rumble (ed.) CRC Handbook of Chemistry and Physics, 98th Edition, Taylor and Francis, Boca Raton, 2017.

3. Specific bibliography according to individual theme design.

Optional bibliography

4. K. Scott, Electrochemical reaction engineering, Academic Press, London, 1991.

9. Evaluation

Type of activity	9.1 Evaluation criteria[3]	9.2 Evaluation methods[4]	9.3 Percentage in the final grade
9.4. Course	Correctness of answers –proper understanding and learning of notions and concepts discussed during lectures; Correct use of learned concept within new contexts. Correct solving of the problems as part of the examination subjects	Written examination. The Access to the exam is conditional on submitting the project. Proven or intended fraud is punished according to the ECST rules of UBB.	40%
9.5. Seminar/ project	Correctness of answers –proper understanding and learning of notions and concepts discussed during lectures; Correct use of learned concept within new contexts.		10%
	Correctness of the project. Rhythmic resolution of the design stages. Delay in completing the stages will lead to a 0.5p deduction/stage and week.		50%
9.6 Minimum standard for passing			
Grade 5 (five) both in the project and in the exam according to the scale.			

[3] 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.

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

10. SDG labels (Sustainable Development Goals)[5]

	○	Sustainable Development Generic Label

								
○	○	○	○	○	○	○	○	◉
								No label applies
○	○	○	○	○	○	○	○	○

Date:
27.04.2026

Signature of course coordinator

Conf. Dr.Eng. Adrian NICOARĂ

Signature of seminar coordinator

Conf. Dr.Eng. Adrian NICOARĂ

Date of approval:
30.04.2026

Signature of the head of department

Prof.habil.dr.eng. Graziella Liana Turdean

[5] 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."*