UNIVERSITATEA BABEŞ-BOLYAI
BABEŞ-BOLYAI TUDOMÁNYEGYETEM
BABEŞ-BOLYAI UNIVERSITÄT
BABEŞ-BOLYAI UNIVERSITY
TRADITIO ET EXCELLENTIA

Tradiție și Excelență prin
Cultură - Știință - Inovație din 1581

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
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SYLLABUS

Design of Electrochemical reactors

University year 2025-2026

1. Information regarding the programme

1.1. Higher education institution	Babes Bolyai University, Cluj Napoca
1.2. Faculty	Chemistry and Chemical Engineering
1.3. Department	Chemical Engineering
1.4.Field of study	Chemical Engineering
1.5.Study cycle	Master
1.6. Study programme/Qualification	Advanced chemical process engineering
1.7. Form of education	Full time education

2. Information regarding the discipline

2.1. Name of the discipline	**Design of Electrochemical reactors**				Discipline 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 evaluation	VP	2.7. Discipline regime	DS (optional)

3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	4	of which: 3.2 course	2	3.3 seminar/project	1/1
3.4. Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar/project	14/14
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
3.5.1. Learning using manual, course support, bibliography, course notes (SA)					28
3.5.2. Additional documentation (in libraries, on electronic platforms, field documentation)					14
3.5.3. Preparation for seminars/labs, homework, papers, portfolios and essays					18
3.5.4. Tutorship					3
3.5.5. Evaluations					3
3.5.6. Other activities:					3
3.7. Total individual study hours	**69**				
3.8. Total hours per semester	**125**				
3.9. Number of ECTS credits	**5**				

4. Prerequisites (if necessary)

4.1. curriculum	• Not the case
4.2. competencies	• Not the case

5. Conditions (if necessary)

5.1. for the course	• The students will switch off the mobile phones • Delays will not be tolerated

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5.2. for the seminar /lab activities	• The students will switch off the mobile phones • Delays will be penalised with 0.5 points/day

6.1. Specific competencies acquired[1]

Professional/essential competencies	○ Definition of notions, concepts, theories and detailed models in the field of electrochemical process engineering and professional activity ○ Use of thorough knowledge in the field of electrochemical engineering for explanation and interpretation of electrode processes ○ Identification and application of concepts, methods and advanced theories for complex problem solving in the field of electrochemical engineering ○ Critical analysis and use of principles, methods and advanced work techniques for qualitative and quantitative assessments of electrochemical engineering processes ○ Evaluation and critical analysis of processes, equipments and units based on concepts, theories, models, methods and design practice for identification of suitable design solutions ○ Identification of concepts, specific resource management and quality assurance theories in electrochemical process industries in the context of sustainable development ○ Resource management for non-polluting and low energy consumption technologies ○ Use of quantitative and qualitative methods in new project design with respect to the quality and resource management principles
Transversal competencies	• Independent execution of complex professional duties and research projects using computer-aided techniques and comply with professional ethics and moral • Planning, monitoring and assuming professional duties of underline group. Proving the coordination capabilities, analytical thinking, adaptability and flexibility, collaboration with team members • Auto-evaluation of professional performances and establish the needs of continuous learning, documentation in the work fields in correlation with the labour market

6.2. Learning outcomes

Knowledge	The student knows: the basic notions of physical chemistry and chemical engineering applied to electrochemical reactors.
Skills	The student is able to understand and the chemical and electrical aspects of the elementary processes from electrochemical processes. The practical activities will allow the student de identify and use the proper electrochemical reactor type, to design for given performance criterions of various electrochemical technologies.
Responsibility and autonomy:	The student has the ability to work independently by completing the exercises/applications presented in the course/seminar; The student has the ability to follow the correctness of experimentally obtained results by comparing them with experimental data/data from specialized literature.

[1] One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

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7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Acquisition of knowledge concerning the design of electrochemical reactors (ER) used in industrial production of related substances (inorganic, organic or organometallics), electrochemical processing of solid materials (electromachining and galvanotechnics)
7.2 Specific objective of the discipline	• Ability to achieve the design of RE and their integration into the design of a complex process. Strengthen knowledge of chemical engineering of the balance of mass and energy • Familiarity with issues specific electrochemical processes, the electrochemical equipment and acquisition of practical skills in using them, and choosing the best methods of operation depending on the specific process in question • Skills related to using data from literature in the design of electrochemical processes

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, 2025, 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

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

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- By learning the theoretical concepts and methodological approaches, students acquire practical aspects of discipline **Design of Electrochemical reactors**, a body of knowledge consistent with the competencies required by the Supplement at degrees and qualifications of ANC.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Correct responses – deep understanding of the concepts treated in the course	Oral exam – the access to the exam is conditioned by the presentation of project works Exam fraud is punished by expulsion from the exam and from the whole programme according to the rules set up in ECST UBB	30 %
10.5 Project	Quality of the individual projects	Evaluation of scientific content of the project.	50 %
10.6 Seminar activities	Correct responses – deep	Activity during the	20 %

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	understanding of the concepts treated in the seminar	seminar	

10.6 Minimum standard of performance

- Grade 5 in seminar works, project and exam.
- Knowledge about notions, concepts, theories and detailed models in the field of electrochemical process engineering and utilisation in professional activity
- Evaluation and critical analysis of processes, equipments and units based on concepts, theories, models, methods and design practice for identification of suitable design solutions

11. Labels ODD (Sustainable Development Goals)[2]

Date:
01.04.2025

Signature of course coordinator

Conf. Dr.Eng. Adrian NICOARĂ

Signature of seminar coordinator

Conf. Dr.Eng. Adrian NICOARĂ

Date of approval:
15.04.2025

Signature of the head of department

Prof. Dr. Ing. Graziella Liana Turdean

[2] Keep only the labels that, according to the *Procedure for applying ODD labels in the academic process*, suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable*.".