SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babes-Bolyai University
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

2. Information regarding the discipline

2.1 Name of the discipline	Electrochemical Reactors Design - 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	C	2.7 Type of discipline	DS/Op

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:					hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars, homework project, papers					20
Tutorship					6
Evaluations					3
Other activities:					

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

6. Specific competencies acquired

Professional 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

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	The PowerPoint presentations will be submitted by email a day before the lecture
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, 2019, Available on-line 2. F. Goodridge, K. Scott, Electrochemical process engineering: A Guide to the design of electrolytic 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	Explanation; Conversation; Description;	The seminary hours were distributed in 7 sessions of 2 hours, one session every 2 weeks.
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. 2. N. Vaszilcsin, Maria Nemes, L. Oniciu, P. Ilea, Electrochimie - aplicaţii numerice, Editura Politehnica, Timişoara, 1999.		
8.3. Project		
Designing of an electrochemical reactor for a specific electrochemical process.	Presentation; Explanation Conversation; Description; Debate	The project hours were distributed in 7 sessions of 2 hours, one session every 2 weeks.
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

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the 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	40 %
10.5 Project	Quality of the individual projects	Evaluation of scientific content of the project.	40 %
10.5 Seminar/lab activities	Correct responses – deep understanding of the concepts treated in the seminar	Activity during the seminar	20 %
10.6 Minimum performance standards			
• 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			

Date	Signature of course coordinator	Signature of seminar coordinator
10.04.2023	Conf. Dr.Eng. Adrian NICOARĂ	Conf. Dr.Eng. Adrian NICOARĂ

Date of approval	Signature of the head of department
25.04.2023	Prof. Dr. Ing. Graziella Liana Turdean