

## 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 / Master's Degree

### 2. Information regarding the discipline

2.1 Name of the discipline			Design of Electrochemical reactors - CMX7345				
2.2 Course coordinator			Prof. Dr. Eng. Petru ILEA				
2.3 Seminar coordinator			Prof. Dr. Eng. Petru ILEA				
2.4. Year of study	II	2.5 Semester	3	2.6. Type of evaluation	C	2.7 Type of discipline	Optional

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

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					28
Additional documentation (in libraries, on electronic platforms, field documentation)					35
Preparation for seminars, homework project, papers					28
Tutorship					14
Evaluations					3
Other activities: .....					
3.7 Total individual study hours	108				
3.8 Total hours per semester	150				
3.9 Number of ECTS credits	6				

### 4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"> <li>Not the case</li> </ul>
4.2. competencies	<ul style="list-style-type: none"> <li>Not the case</li> </ul>

### 5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> <li>The students will switch off the mobile phones</li> <li>Delays will not be tolerated</li> </ul>
5.2. for the seminar activities	<ul style="list-style-type: none"> <li>The students will switch off the mobile phones</li> <li>Delays will be penalised with 0.5 points/day</li> </ul>

## 6. Specific competencies acquired

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• Definition of notions, concepts, theories and detailed models in the field of electrochemical process engineering and professional activity</li> <li>• Use of thorough knowledge in the field of electrochemical engineering for explanation and interpretation of electrode processes</li> <li>• Identification and application of concepts, methods and advanced theories for complex problem solving in the field of electrochemical engineering</li> <li>• Critical analysis and use of principles, methods and advanced work techniques for qualitative and quantitative assessments of electrochemical engineering processes</li> <li>• Evaluation and critical analysis of processes, equipments and units based on concepts, theories, models, methods and design practice for identification of suitable design solutions</li> <li>• Identification of concepts, specific resource management and quality assurance theories in electrochemical process industries in the context of sustainable development</li> <li>• Resource management for non-polluting and low energy consumption technologies</li> <li>• Use of quantitative and qualitative methods in new project design with respect to the quality and resource management principles</li> </ul>
<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>• Independent execution of complex professional duties and research projects using computer-aided techniques and comply with professional ethics and moral</li> <li>• Planning, monitoring and assuming professional duties of underline group. Proving the coordination capabilities, analytical thinking, adaptability and flexibility, collaboration with team members</li> <li>• Auto-evaluation of professional performances and establish the needs of continuous learning, documentation in the work fields in correlation with the labour market</li> </ul>

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• 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)</li> </ul>
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> <li>• 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</li> <li>• 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</li> <li>• Skills related to using data from literature in the design of electrochemical processes</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. Basic concept in electrochemical reactor design	Presentation; Explanation, Conversation; Description; Debate	
8.1.2. Specific aspects of electrochemical reactor	Presentation; Explanation, Conversation; Description; Debate	
8.1.3. Mass transport in electrochemical reactor	Presentation; Explanation, Conversation; Description; Debate	

8.1.4. Energy balances in electrochemical reactor	Presentation; Explanation, Conversation; Description; Debate	
8.1.5. The rate of the electrochemical processes	Presentation; Explanation, Conversation; Description; Debate	
8.1.6. Electrochemical reactor (ER) Models (I) Discontinuous ER	Presentation; Explanation Conversation; Description; Debate	
8.1.7. Electrochemical reactor Models (II) Displacement ER	Presentation; Explanation Conversation; Description; Debate	
8.1.8 Electrochemical reactor Models (III) Perfect mixture ER	Presentation; Explanation Conversation; Description; Debate	
8.1.9. ER design (I) ER active surface design	Presentation; Explanation Conversation; Description; Debate	
8.1.10. ER design (II) ER electric and hydraulic connections	Presentation; Explanation Conversation; Description; Debate	
8.1.11. ER design (III) Evaluation of ER performance parameters (current and voltage yield, specific energy consumption, specific chemical yield)	Presentation; Explanation Conversation; Description; Debate	
8.1.12. Optimisation of ER performance	Presentation; Explanation Conversation; Description; Debate	
8.1.13. Modelling of ER	Presentation; Explanation Description; Debate	
8.1.14. Economic performances evaluation of ER	Presentation; Explanation Conversation; Description; Debate	
Bibliography 1. L. Oniciu, P. Ilea, Ionel Căţalin Popescu, „Electrochimie tehnologică”, Casa Cărţii de Ştiinţă, Cluj-Napoca, 1995 2. L. Oniciu, Liana Mureşan, „Electrochimie aplicată”, Presa Universitară Clujeana, 1998. 3. P. Ilea, „Electrosinteze anorganice”, Casa Cărţii de Ştiinţă, Cluj-Napoca, 2006 4. F. Goodridge, K. Scott, Electrochemical process engineering: A Guide to the design of electrolytic plant, Plenum, New York, London, 1995 5. N. Vaszilcsin, Maria Nemes, L. Oniciu, P. Ilea, Electrochimie - aplicaţii numerice, Editura Politehnica, Timişoara, 1999		
8.2 Seminar	Teaching methods	Remarks
8.2.1. Summarize of basic electrochemistry concepts	Explanation; Conversation; Description;	
8.2.2. Mass transport, electrochemical reactions rate and energy balance in the ER	Explanation; Conversation; Description	
8.2.3. ER Models	Explanation; Conversation; Description;	
8.2.4. ER design	Explanation; Conversation; Description;	
8.2.5. Economic performances evaluation, electrochemical processes modelling and optimization	Explanation; Conversation; Description;	
8.2.6. Design an electrochemical reactor for an electrochemical process	Explanation; Conversation; Description;	
Bibliography 1. F. Goodridge, K. Scott, Electrochemical process engineering: A Guide to the design of electrolytic plant, Plenum, New York, London, 1995 2. Specific bibliography according to individual theme design <b>Optional bibliography</b> 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 instructing the theoretical and practical concepts of **Design of Electrochemical reactors** - course, the students will get the knowledge in accordance with the competencies requested by possible employment sectors stetted by RNCIS.

**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	50 %
10.5 Seminar/lab activities	Correct responses – deep understanding of the concepts treated in the seminar	Project will handed in the last week of Semester	50 %
	Quality of the individual projects		
	Activity during the seminar		
10.6 Minimum performance standards			
<ul style="list-style-type: none"><li>• Grade 5 both in seminar works and exams</li><li>• Knowledge about notions, concepts, theories and detailed models in the field of electrochemical process engineering and utilisation in professional activity</li><li>• Evaluation and critical analysis of processes, equipments and units based on concepts, theories, models, methods and design practice for identification of suitable design solutions</li></ul>			

Date

24.09.2012

Date of approval

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Signature of course coordinator

Prof. Petru ILEA

Signature of seminar coordinator

Prof. Petru ILEA

Signature of the head of department

Assoc. Prof. Eng. Mircea Cristea