

# SYLLABUS

## 1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty <sup>1</sup> / Department <sup>2</sup>	Chemical Engineering, Biotechnologies and Environmental Protection / CAICAM
1.3 Field of study (name/code <sup>3</sup> )	Chemical Engineering / 10.30.50
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	Chemical Engineering / 10.30.50.60 / engineer

## 2. Information about the discipline

2.1 Name of discipline/ formative category <sup>4</sup>	Electrochemistry and corrosion III (Electrochemical processes) / DS						
2.2 Coordinator (holder) of course activities	Assist.prof. dr.eng. Andrea KELLENBERGER						
2.3 Coordinator (holder) of applied activities <sup>5</sup>	Assist.prof. dr.eng. Andrea KELLENBERGER						
2.4 Year of study <sup>6</sup>	IV	2.5 Semester	7	2.6 Type of evaluation	D	2.7 Regime of discipline <sup>7</sup>	DO

## 3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted)<sup>8</sup>

3.1 Number of fully assisted hours / week	4.5 of which:	3.2 course	2	3.3 seminar / laboratory / project	0/2.5/0
3.1* Total number of fully assisted hours / semester	63 of which:	3.2* course	28	3.3* seminar / laboratory / project	0/3.5/0
3.4 Number of hours partially assisted / week	of which:	3.5 training		3.6 hours for diploma project elaboration	
3.4* Total number of hours partially assisted / semester	of which:	3.5* training		3.6* hours for diploma project elaboration	
3.7 Number of hours of unassisted activities / week	2.64 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0.5
		hours of individual study after manual, course support, bibliography and notes			1.5
		training seminars / laboratories, homework and papers, portfolios and essays			0.64
3.7* Number of hours of unassisted activities / semester	37 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			7
		hours of individual study after manual, course support, bibliography and notes			21
		training seminars / laboratories, homework and papers, portfolios and essays			9
3.8 Total hours / week <sup>9</sup>	7.14				
3.8* Total hours /semester	100				
3.9 Number of credits	4				

## 4. Prerequisites (where applicable)

4.1 Curriculum	<ul style="list-style-type: none"> <li>Inorganic chemistry, physical chemistry, electrochemistry</li> </ul>
4.2 Competencies	<ul style="list-style-type: none"> <li>Description, analysis and use of fundamental concepts and theories in the field of</li> </ul>

<sup>1</sup> The name of the faculty which manages the educational curriculum to which the discipline belongs

<sup>2</sup> The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.

<sup>3</sup> The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.

<sup>4</sup> Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).

<sup>5</sup> Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

<sup>6</sup> Year of studies in which the discipline is provided in the curriculum.

<sup>7</sup> Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).

<sup>8</sup> The number of hours in the headings 3.1 \*, 3.2 \*, ..., 3.8 \* is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.

<sup>9</sup> The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

	engineering sciences
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### 5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> <li>• Classroom equipped with blackboard and video projector</li> </ul>
5.2 to conduct practical activities	<ul style="list-style-type: none"> <li>• Laboratory with appropriate equipment</li> </ul>

### 6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> <li>• Recognize and describe the basic notions and concepts related to electrochemical engineering and electrochemical processes</li> <li>• Identify and describe the components of electrochemical reactors</li> <li>• Explain electrochemical processes in metal electroplating (nickel, copper zinc plating)</li> <li>• Explain electrochemical processes in electrolytic extraction and refining of metals</li> <li>• Analysis of industrial electrochemical processes</li> <li>• Recognize and describe different types of water electrolyzers</li> </ul>
Professional competencies ascribed to the specific competencies	<ul style="list-style-type: none"> <li>• - Analyse production processes for improvement;</li> <li>• - Manage chemical testing procedures;</li> <li>• - Test materials;</li> <li>• - Write technical reports</li> <li>• -Performs chemical experiments</li> <li>• -Approve engineering design</li> <li>• -Assess environmental impact</li> </ul>

Transversal competencies ascribed to the specific competencies

- - Conduct quality control;
- - Apply scientific, technological and engineering knowledge;
- - Uses equipment, instruments or technological equipment accurately.

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### 7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	<ul style="list-style-type: none"> <li>• Acquiring knowledge about electrode processes and electrochemical engineering</li> </ul>
7.2 Specific objectives	<ul style="list-style-type: none"> <li>• Defining the basic notions, concepts and theories of electrochemical engineering and electrode processes</li> <li>• Identify and apply concepts, methods and theories to solve electrochemical engineering problems</li> <li>• Explain and interpret electrode processes involved in electroplating, electrometallurgy and other industrial electrochemical processes</li> <li>• Critical analysis and use of principles, methods and working techniques for quantitative and qualitative evaluation of electrochemical processes</li> <li>• Explanation and interpretation of principles and methods used in the operation of electrochemical industrial processes and installations</li> <li>• Critical evaluation of processes, equipment, procedures and products in electrochemical industrial processes</li> </ul>

### 8. Content<sup>10</sup>

<sup>10</sup> It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(\*)".



anodizing. Coloring of anodized aluminum layers.		
Bibliography <sup>14</sup>		
1. Holze, R., Experimental electrochemistry: a laboratory textbook, Wiley-VCH, Weinheim, 2009		
2. Fuller, T.F., Harb, J.N., Electrochemical Engineering, Wiley, 2018.		
3. Schlesinger, M., Paunovic, M., Modern electroplating, Wiley, Hoboken, 2010.		
4. Dan, M.L., Duca, D.A., Vaszilcsin, N., Introducere în tehnologia proceselor electrochimice, Editura Politehnica, Timișoara, 2018.		
5. Nemes, M., Vaszilcsin, N., Kellenberger, A., Electrochimie. Principii și experiențe, Editura Politehnica Timisoara, 2009		

**9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program**

- The content of the discipline was established following discussions in the Board of Chemical Engineering field, considering the requirements of the employers and labor market. The discipline corresponds to the curricula of other chemical engineering faculties both nationally and internationally.

**10. Evaluation**

Type of activity	10.1 Evaluation criteria <sup>15</sup>	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Evaluation of theoretical knowledge. Evaluation of the capacity to comprehend and analyze electrochemical processes	2 written/online tests to verify theoretical knowledge, scheduled during the semester	0.67
10.5 Applied activities	<b>S:</b>		
	<b>L:</b> Evaluation of: - involvement in experimental work; - presentation of results; - accuracy of data interpretation	Discussion with students, follow-up of practical works, lab reports and laboratory tests	0.33
	<b>P</b> <sup>16</sup> :		
	<b>Pr:</b>		
<b>10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified <sup>17</sup>)</b>			
<ul style="list-style-type: none"> <li>Acquisition of basic concepts related to electrochemical engineering and electrochemical processes; a minimum grade of 5 in each of the 2 written / online evaluation tests.</li> <li>A minimum grade of 5 for the applied activities, provided that all laboratory works are carried out and all related reports are handed over.</li> </ul>			

**Date of completion**

**Course coordinator  
(signature)**

Conf.dr.ing. Andrea KELLENBERGER

**Coordinator of applied activities  
(signature)**

Conf.dr.ing. Andrea KELLENBERGER

**Head of Department  
(signature)**

Conf.dr.ing. Andrea  
KELLENBERGER

**Date of approval in the Faculty Council <sup>18</sup>**

**Dean  
(signature)**

Ș.L.dr.ing. Mircea Laurențiu DAN

<sup>14</sup> At least one title must belong to the discipline team.

<sup>15</sup> Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

<sup>16</sup> In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.

<sup>17</sup> It will not explain how the promotion mark is awarded.

<sup>18</sup> The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.