

# 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 / CAICON
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>	Spectroscopic and Chromatographic Methods / DS						
2.2 Coordinator (holder) of course activities	S.L.dr.ing. Valentin BADEA/ S.L.dr.ing. Valentin ORDODI						
2.3 Coordinator (holder) of applied activities <sup>5</sup>	S.L.dr.ing. Valentin BADEA/ S.L.dr.ing. Valentin ORDODI						
2.4 Year of study <sup>6</sup>	III	2.5 Semester	5	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 of which:	3.2 course	2	3.3 seminar / laboratory / project	0/2/0
3.1* Total number of fully assisted hours / semester	56 of which:	3.2* course	28	3.3* seminar / laboratory / project	0/28/0
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	3.14 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			1
		hours of individual study after manual, course support, bibliography and notes			1,14
		training seminars / laboratories, homework and papers, portfolios and essays			1
3.7* Number of hours of unassisted activities / semester	44 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			12
		hours of individual study after manual, course support, bibliography and notes			18
		training seminars / laboratories, homework and papers, portfolios and essays			14
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>Organic chemistry, physical chemistry, structure and properties of molecules</li> </ul>
4.2 Competencies	<ul style="list-style-type: none"> <li>Proficiency in handling laboratory utensils and equipment</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.

## 5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> <li>• Classroom equipped with blackboard and video projector</li> <li>• Students attending the class will have their cell phones on airplane mode or switched off</li> <li>• Student participation in the course according to the regulations in the APPENDIX TO H.S. NO. 233 of 15.09.2016, APPENDIX no. 4 of the UPT Charter</li> </ul>
5.2 to conduct practical activities	<ul style="list-style-type: none"> <li>• Spaces and facilities:               <ul style="list-style-type: none"> <li>• UV-VIZ spectroscopy laboratory, IR spectroscopy laboratory, Mass spectrometry laboratory, NMR spectroscopy laboratory, Gas chromatography laboratory</li> </ul> </li> <li>• Student obligations:               <ul style="list-style-type: none"> <li>• Compliance with labor protection rules and instructions in the laboratory</li> <li>• Mandatory use of personal protective equipment</li> <li>• Correct and careful use of the equipment, utensils and materials in the laboratory</li> </ul> </li> <li>• The performance of practical laboratory work by students is conditioned by the acquisition of some minimum knowledge presented in the laboratory report. Verification of this knowledge will be done by taking tests before each practical laboratory work. The minimum test grade for the practical performance of the laboratory work is 5.00. Otherwise, the student will be informed that he cannot participate in the practical work, which will be recovered in separate sessions according to the regulation in the APPENDIX TO H.S. NO. 233 of 15.09.2016, APPENDIX no. 4 of the UPT Charter.</li> </ul>

## 6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> <li>• The use of equipment and methods of analysis and characterization specific to organic chemical products: preparation of samples for spectroscopic and chromatographic analyses, basic spectroscopic techniques and the interpretation of spectra, TLC and electrophoretic methods, gas chromatographic techniques and the determination of the main chromatographic parameters</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.

<ul style="list-style-type: none"> <li>•</li> </ul>
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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>• The objective of the discipline is to acquire the basic notions related to the analysis and control methods used in chemistry laboratories with an organic profile.</li> </ul>
7.2 Specific objectives	<ul style="list-style-type: none"> <li>• Two directions will be followed: the study of spectroscopic methods of analysis and</li> </ul>

determination of the structure of chemical compounds as well as the control of chemical processes by chromatographic methods.

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

8.1 Course	Number of hours	Teaching methods <sup>11</sup>
Electronic spectroscopy introductory elements. UV-VIS spectrophotometric method. (theoretical presentation and applications)	2	Interactive teaching, lecture, demonstration, problem solving, case study, cooperative learning methods and techniques; Exposure with a video projector for fixing and consolidating knowledge. Course materials will be printed or sent via e-mail, resource page in electronic format on the virtual campus.
Infrared spectroscopy as a method for characterizing organic compounds (theoretical presentation and applications).	3	
Nuclear magnetic resonance spectroscopy as a method for characterizing and determining the structure of organic compounds (theoretical presentation and applications).	5	
Mass spectrometry as a method for characterizing organic compounds (theoretical presentation and applications).	2,5	
Integrated methods of characterization of organic compounds and control of chemical reactions	1,5	
Principles of chromatographic analysis methods	2	
Gas chromatography on capillary columns and packed columns as a method for qualitative and quantitative analysis of organic compounds	10	
Chromatographic analysis as an analytical method in industry. Process chromatography.	2	
Bibliography <sup>12</sup> 1. V. Badea, M. Medeleanu, <i>Metode spectroscopice utilizate în analiza compușilor organici</i> , Universitatea Politehnica Timișoara, Note de curs		
2. R. Bacaloglu, C. Csunderlik, L. Cotarcă, H.H. Glatt, <i>Structura și proprietățile compușilor organici</i> , Editura Tehnică, București 1985, vol I		
3. R.M. Silverstein, F.X. Webster, D. J. Kiemle <i>Spectrometric identification of organic compounds</i> , John Wiley & Sons, Inc., New York, 8th ed., 2005		
4. A.T. Balaban, M. Banciu, I.I. Pogany <i>Aplicații ale metodelor fizice în chimia organică</i> , Ed. Științifică și Enciclopedică, București, 1983		
5. C. Liteanu, S. Gocan., A. Bold <i>Separatologie analitică</i> , Ed. Dacia, Cluj-Napoca, 1981		
6. R. L. Grob, E. F. Barry <i>Modern practice of gas chromatography</i> , John Wiley & Sons, Inc., Hoboken, New Jersey, 4th ed., 2004		
7. F. G. Kitson, B. S. Larsen, Ch. M. McEwen <i>Gas chromatography and mass spectrometry</i> , Academic Press, 1996		
8. Poole F.C, <i>Gas Chromatography</i> , Elsevier, 2012.		
9. Ciucanu, I., <i>Metode Fizico-Chimice în Analiza Chimica Instrumentala</i> , Editura Mirton, Timisoara, 1996		
8.2 Applied activities <sup>13</sup>	Number of hours	Teaching methods
1. Work safety rules. Introduction to experimental spectroscopic and chromatographic techniques.	2	Education
2. UV-Vis spectrophotometry: experimental determinations and spectral applications for organic compounds	2	Practical activity in the laboratory, Experimental data processing and their interpretation
3. Infrared spectroscopy: experimental determinations and spectral applications for organic compounds	2	
4. Nuclear magnetic resonance spectroscopy: experimental determinations and spectral applications for organic compounds	2	
5. Mass spectrometry: experimental determinations and spectral applications for organic compounds	3	
6. Combined spectrophotometric and spectroscopic methods for organic compounds	2	Work individually or in teams of 3-4 people
Separation by TLC and paper chromatography of some organic	2	Work individually or in

<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 "(\*)".

<sup>11</sup> Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

<sup>12</sup> At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.

<sup>13</sup> Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".

compounds with biological activity		teams of 3-4 people
Gel electrophoretic technique. Applications on some synthetic dyes	2	Work individually or in teams of 3-4 people
Determination of the main parameters of chromatographic retention, efficiency of the chromatographic column	4	Work individually or in teams of 3-4 people
Qualitative and quantitative analysis in gas chromatography	3	Work individually or in teams of 3-4 people
Gas chromatographic method coupled with mass spectrometry, for complex analytical control through integrated experimental determinations of organic compounds.	3	Work individually or in teams of 3-4 people
Bibliography <sup>14</sup> 1. Laboratory reports available in electronic and printed format 2. M. Medeleanu, M. Milea, <i>Metode spectroscopice în chimia organică – Îndrumător de laborator</i> , Ed. Univ. "Politehnica", Timișoara, 1998 3. Medvedovici, A., <i>Noțiuni fundamentale și marimi caracteristice în cromatografie</i> , Univ Bucuresti , 1998 4. Ciucanu, I., <i>Metode Fizico-Chimice în Analiza Chimica Instrumentala</i> , Editura Mirton, Timisoara, 1996		

**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**

<ul style="list-style-type: none"> <li>When we preparing the content of the discipline, the requirements of representative employers in the field of the chemical industry were taken into account, whose activity also includes laboratory analysis as well as quality control of technological processes.</li> </ul>
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**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	Knowledge assessment interest	Assessment: oral exam for spectroscopic methods and multiple choice questions for chromatographic methods	66%
10.5 Applied activities	<b>S:</b>	Written evaluation/multiple choice questions	34%
	<b>L:</b> Assessment of practical knowledge		
	<b>P<sup>16</sup>:</b>		
	<b>Pr:</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> )			
<ul style="list-style-type: none"> <li>Solving at least 50% of the subjects in the oral and written examination and at least grade 5 in the activity of the semester – laboratory activity</li> </ul>			

Date of completion

Course coordinator  
(signature)

Valentin BADEA

Coordinator of applied activities  
(signature)

Valentin BADEA

Laurențiu Valentin ORDODI

Laurențiu Valentin ORDODI

Head of Department  
(signature)

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

Dean  
(signature)

<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.

