SYLLABUS

1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty[1]/ Department [2]	Chemical Engineering, Biotechnologies and Environmental Protection / CAICON
1.3 Field of study (name/code[3])	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[4]			Surfactants / DS				
2.2 Coordinator (holder) of course activities			S.L.dr.ing. Sabina NIȚU				
2.3 Coordinator (holder) of applied activities[5]			S.L.dr.ing. Sabina NIȚU				
2.4 Year of study[6]	IV	**2.5** Semester	7	**2.6** Type of evaluation	D	**2.7** Regime of discipline[7]	DO

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

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	0.78
3.4* Total number of hours partially assisted / semester	of which:	**3.5*** training		**3.6*** hours for diploma project elaboration	0.78
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			1.58
		hours of individual study after manual, course support, bibliography and notes			
		training seminars / laboratories, homework and papers, portfolios and essays			
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			11
		hours of individual study after manual, course support, bibliography and notes			11
		training seminars / laboratories, homework and papers, portfolios and essays			22
3.8 Total hours / week [9]	7.14				
3.8* Total hours /semester	100				
3.9 Number of credits	4				

4. **Prerequisites** (where applicable)

4.1 Curriculum	• Organic chemistry. Organic technology, Fundamental processes in organic synthesis

[1] The name of the faculty which manages the educational curriculum to which the discipline belongs
[2] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[3] The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.
[4] 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).
[5] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[6] Year of studies in which the discipline is provided in the curriculum.
[7] 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).
[8] 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.
[9] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

4.2 Competencies	• Laboratory activities, design elements

5. Conditions (where applicable)

5.1 of the course	• Lecturer room, equipped with video projector, screen, computer and board. The use of the mobile phones for calls, messages or recording laboratory activities is prohibited
5.2 to conduct practical activities	• Appropriately equipped laboratory for surfactants synthesis and characterisation; The students will have lab coat on and their mobile phones turned off, they will be trained to respect the labor protection and PSI rules; They will elaborate a laboratory report after each laboratory work

6. Specific competencies acquired through this discipline

Specific competencies	• Understanding the fundamental concepts and theories of organic chemistry and physical chemistry applied in the field of surfactants. The ability to practically apply theoretical knowledge and to make correlations among acquired knowledge, including those from the other disciplines or fields. • The ability to work in a team to solve an assigned task, including the use of modern documentation methods and specific laboratory and library equipment.
Professional competencies ascribed to the specific competencies	• - Analyse production processes for improvement; • - Manage chemical testing procedures; • - Test materials; • - Write technical reports • -Performs chemical experiments • -Approve engineering design • -Assess environmental impact

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	• Formation and transmission of basic knowledge in the field of surfactants: definition, properties, methods of obtaining and analysis. Their applications
7.2 Specific objectives	• Domain definition. Classification of surfactants based on their structure. • Correlations between their structure, properties and applications in industry or other fields

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
Introduction to surfactants chemistry. Definition, structure, classification, examples	2	Interactive teaching with video support

[10] 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 "(*)".

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

Types of surfactants (anionic, cationic, amphionic, nonionic)		
Behavior of surfactants in solution. Variation of the physical chemical properties of surfactant solutions with its concentration. Formation of spherical, cylindrical and planar bilayers micelles. Critical micellar concentration (CMC) of surfactants solutions. Influence of CMC on the use value of the surfactant	2	
Reduction of surface and interfacial tension by surfactants Dispersion and aggregation of solids in liquid media by surfactants	2	
Emulsions – definition and types. Methods of recognizing the type of an emulsion. Mechanisms of destabilization of emulsions, skimming. Stabilization action of surfactants in emulsions. Application of emulsifiers in industry, agriculture, cosmetics, pharmacy and food industry. Ways to break emulsions. Food emulsifiers.	4	
Foaming – definitions and mechanisms of foam formation. The action of surfactants to stabilize the foams. Foam stability and viscosity. Antifoaming action of surfactants. Applications of surfactants as foaming/antifoaming agents in industry.	2	
Washing and cleaning action of surfactants. Factors that influence washing process. Mechanisms for removing it from surfaces. Application of surfactants in detergents, soaps and shampoos etc.) for personal, household use, automotive and industrial cosmetics. Conditioning of commercial products based on surfactants.	4	
The wetting ability of surfactant solutions and its importance. Methods for determining the wetting power of surfactant solutions. Applications of surfactants as wetting agents (in the textile industry, in dyeing processes, in agriculture, in mineral extraction (flotation)	2	
The hydrophilic-lipophilic balance of a surfactant (HLB). The relationship between HLB value and hydrophilic-lypophilic character. Methods for calculating the HLB value for surfactants from various classes of chemical compounds. The connection between HLB value and the practical use of the surfactant. Methods for selecting an emulsifier based on HLB value. Calculation of HLB for surfactant mixture. Preparation of emulsifier mixtures with a certain HLB value	2	
Industrial synthesis of surfactants. Raw materials for the production of surfactants. Petroleum based surfactants. The ALFOL process for obtaining fatty alcohols. Introduction of hydrophilic groups by sulfonation and sulfation processes. Surfactants based on renewable raw materials	4	
Eco-friendly and biodegradable surfactants. Ethoxylation of fatty alcohols and acids. Green technologies for surfactant production	2	
Natural surfactants and biological derivatives. Innovations in surfactant technology. Smart surfactants. Nanotechnology and surfactants. Current trends in surfactant production and usage	3	
Environmental impact of surfactants Environmental legislation aspects. Environmental protection norms and regulation in the surfactant industry	1	
Bibliography [12] [13] 1. Course notes 2. Milton J. Rosen, „Surfactants and Interfacial Phenomena”, Wiley, 1989, Second Edition.		
8.2 Applied activities [14]	Number of hours	Teaching methods

[12] 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.
[13] Cel puțin un un titlu trebuie să aparțină colectivului disciplinei iar cel puțin un titlu trebuie să se refere la o lucrare de referință pentru disciplină, de circulație națională și internațională, existentă în biblioteca UPT.

Laboratory specific Occupational Safety and Fire Safety Training Presentation of practical work	2	Presentation and explanation of the principle and method of carrying out the works, as well as the interpretation of the results and the calculation of work yields
Determination of the content of anionic active substances in a surfactant	2	
Determination of the content of cationic active substances in a surfactant	2	
Synthesis of a long-chain alkyl sulfosuccinate: analysis of raw materials, monitoring reaction yield through the acidity index of the reaction mixture; characterization of the reaction product	6	
Determination of the surface tension of surfactant solutions	2	
Determination of foaming power; foam stability and density. Determination of the wetting power of surfactant solutions	4	
Critical Micelle Concentration. Experimental determination	2	
Emulsions: stabilization of emulsions; recognition of the emulsion type; destabilization of emulsions	4	
Determination of the hydrophilic-lipophilic balance (HLB) of surfactants. Preparation of emulsifier mixtures with a specific HLB value	4	
Bibliography [15] 1. Protocol and working methods 2. Sabina-Violeta Nițu, "Procese tehnologice chimice - calcule şi lucrări practice", Editura POLITEHNICA, Timișoara, 2016, ISBN: 978-606-350-081-7		

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 is in accordance to the formation requirements of chemical engineers

10. Evaluation

Type of activity	**10.1** Evaluation criteria [16]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Acquiring the main principles and aspects of industrial catalytic processes	Knowledge verification is done by a written tests (1 hour) based on knowledge verification topics and comparative process analysis topics	0.66
10.5 Applied activities	**S:** Delivery of reports with results and conclusions for the works performed. Obtaining experimental results comparable to standard ones.	Partial verification during the course. Discussions of the teaching staff with the students and the correction of the works reports	0.34
	L:		
	P[17]**:**		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [18])			
• 60% at the written test. Performing of all the laboratory works and presentation of the written results.			

Date of completion	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
	S.L. dr. ing. Sabina-Violeta NIȚU	S.L. dr. ing. Sabina-Violeta NIȚU

[14] 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".
[15] At least one title must belong to the discipline team.
[16] 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.)
[17] 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.
[18] It will not explain how the promotion mark is awarded.

Head of Department (signature)	Date of approval in the Faculty Council [19]	Dean (signature)
S.L.dr.ing. Andra TĂMAȘ		S.L.dr.ing.Mircea DAN

[19] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.