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 / CAICAM
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]			Pollution prevention and environmental protection / DS				
2.2 Coordinator (holder) of course activities			S.l. dr. ing Cosmin Vancea				
2.3 Coordinator (holder) of applied activities[5]			……				
2.4 Year of study[6]	III	**2.5** Semester	6	**2.6** Type of evaluation	E	**2.7** Regime of discipline[7]	DI

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	
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	1.36 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			
		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	19 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			
		hours of individual study after manual, course support, bibliography and notes			
		training seminars / laboratories, homework and papers, portfolios and essays			
3.8 Total hours / week [9]	5.36				
3.8* Total hours /semester	75				
3.9 Number of credits	3				

4. **Prerequisites** (where applicable)

4.1 Curriculum	•
4.2 Competencies	•

[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.

5. **Conditions** (where applicable)

5.1 of the course	•
5.2 to conduct practical activities	•

6. **Specific competencies** acquired through this discipline

Specific competencies	•
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.

•

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

7.1 The general objective of the discipline	• Sustainable Chemistry (or sustainable chemistry development) is, arguably, the most pressing societal challenge today. It has become a major factor in decision making of many companies employing chemical engineering graduates. It describes the realm and importance of chemistry and the chemical and pharmaceutical industries, current sustainability bottlenecks such as energy demand, climate change and resource scarcity, and their connection to chemistry. This course will examine the foundation principles of sustainability, the concept of life cycle and its adoption in chemical industry, the concept of circular economy and its implications for chemical industry, and the more challenging topic of sustainability as a complex systems problem.
7.2 Specific objectives	• This course provides an overview of sustainability in a chemical engineering context. The aim is to establish the conceptual framework and foundation for quantitative methods to the analysis of (bio)chemical processes with respect to their impact on sustainability.

8. **Content** [10]

8.1 Course	Number of hours	Teaching methods [11]

[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.).

Concepts of Sustainable Chemistry and Natural Capital	4	Lecture-debate, debate, demonstration, panel discussion, problematization, case study, brainstorming, cooperative learning methods and techniques, etc.
The Circular Economy and Sustainable Business Models	4	
Aspects regarding the environmental chemistry, toxicology, green chemistry and chemo-informatics	2	
Atmosphere: pollution, toxicology, ecotoxicology. Design and Modelling of Chemical industry towards a green industry	4	
Hydrosphere: pollution, toxicology, ecotoxicology. Design and Modelling of Chemical industry towards a green industry	4	
Lithosphere: pollution, toxicology, ecotoxicology. Design and Modelling of Chemical industry towards a green industry	4	
Wastes: sources, recycling technologies in the context of a circular economy	4	
Laws international regulations and chemicals management. Specific environmental protection legislation	2	

Bibliography [12]

1. Anastas, P.T., Warner, J.C., 1998. Green Chemistry: Theory and Practice. Green Chem. Theory Pract. Oxford Univ. Press., New York
2. B.R. Bakshi, Sustainable Engineering. Principles and Practice, Cambridge University Press, 2019.
3. Gerard Kiely, Environmental Engineering, The McGraw-Hill Companies, London, 1997
4. Mackenzie L. Davis, David A. Cornwell, Introduction to Environmental Engineering, The McGraw-Hill Companies, Boston, 2000
5. Edward S. Rubin, Introduction to Engineering and the Environment, The McGraw-Hill Companies, Boston 2001
6. Ram S. Gupta PhD, Environmental Engineering and Science, Government Institutes and Science, Government Institutes Rockville, MD, 1997
7. David H.F. Liu, Bela G. Liptak, Paul A. Boris, Environmental Engineers' Handbook, Lewis Publishers, Boca Raton, New York, 1997
8. Robert A. Corbitt, Standard Handbook of Environmental Engineering, The McGraw-Hill Companies, New York, 1998
9. ***, Legea 211/2011 privind regimul deseurilor

8.2 Applied activities [13]	Number of hours	Teaching methods
Labor protection	4	Training methods used during practical application hours: cooperative learning methods and techniques, debate, case study, panel discussion, problem solving, brainstorming, project, SWOT analysis, etc.
Determination of air pollutants. Determination of noise	4	
Determination of drinking water quality parameters	4	
Determination of some soil quality parameters	4	
Establishing the class of waste for their storage	4	
Soil depollution through bioremediation. Depollution of wastewater polluted with heavy metals by bioremediation	4	
Laboratory recovery	4	

[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] 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".

1. Bibliography [14]

1. G. Mosoarca, A. Negrea, Chimia solului. Aplicatii, Editura Politehnica Timisoara, 2006

2. C. Muntean, A. Negrea, L. Lupa, M. Ciopec, Analiza chimica si fizico-chimica cu aplicatii in protectia mediului, Editura Politehnica Timisoara, 2009

3. V. Stefan, Pedologie, Lucrări practice, Editura Lumina, Dr.Tr. Severin, 2004

4. E. Lungu, L. Duda, Poluarea mediului şi tehnologii de combatere, Editura Mirton, Timişoara, 1999

5. M. CIopec, A. Negrea, Protecţia mediului.Lucrări practice, Ed. Politehnica, Timişoara, 2016

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 drawn up in strict accordance with the requirements of professional associations, but especially with the requests of representative employers in the field of environmental protection.

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Examination	The evaluation consists in passing the exam with subjects in the form of questions	0.67
10.5 Applied activities	**S:**		
	L: mandatory attendance	Teaching and presenting the papers at the end of the laboratory and marking them	0.33
	P[16]**:**		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [17])			
• The training goal of the course is for the student to acquire the notions of pollution of environmental factors (sources and effects) and a series of technologies and equipment used in their depollution. At the end of the course, students must have new and advanced knowledge in the field of green chemistry, sustainability concepts, environmental protection concepts, depollution techniques and equipment and the reduction of pollution of environmental factors.			

Date of completion	**Course coordinator (signature)** S.l.dr.ing. Cosmin Vancea	**Coordinator of applied activities (signature)** S.l.dr.ing. Cosmin Vancea
Head of Department (signature) Conf. dr. eng. Andrea KELLENBERGER	**Date of approval in the Faculty Council** [18]	**Dean (signature)** Ș.L. dr. ing. Mircea Laurențiu DAN

[14] At least one title must belong to the discipline team.

[15] 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.)

[16] 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.

[17] It will not explain how the promotion mark is awarded.

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