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]			Analytical chemistry and instrumental analysis I / DD				
2.2 Coordinator (holder) of course activities			Conf.dr.ing. Cornelia MUNTEAN				
2.3 Coordinator (holder) of applied activities[5]			Conf.dr.ing. Cornelia MUNTEAN, S.L.dr.ing. Laura COCHECI				
2.4 Year of study[6]	I	**2.5** Semester	2	**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	4.93 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0.93
		hours of individual study after manual, course support, bibliography and notes			2
		training seminars / laboratories, homework and papers, portfolios and essays			2
3.7* Number of hours of unassisted activities / semester	69 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			13
		hours of individual study after manual, course support, bibliography and notes			28
		training seminars / laboratories, homework and papers, portfolios and essays			28
3.8 Total hours / week [9]	8.93				
3.8* Total hours /semester	125				
3.9 Number of credits	5				

4. **Prerequisites** (where applicable)

4.1 Curriculum	• Fundamentals of General chemistry, Inorganic chemistry

[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	• Making simple measurements; Simple calculations and operations with logarithms; Graphic representations on graph paper and with the help of software

5. Conditions (where applicable)

5.1 of the course	• Room of appropriate size, supporting materials: laptop, projector, blackboard
5.2 to conduct practical activities	• Laboratory with specific equipment, computer, blackboard

6. Specific competencies acquired through this discipline

Specific competencies	• Description and application of the theoretical bases of analytical chemistry, equilibria in solutions and the principles of qualitative chemical analysis • Taking samples and preparing them for analysis • Performing the measurement operations necessary for analyzes (weighing, volume measurements, pH measurement, preparation of solutions) • Identification of cationic, anionic chemical species and organic functional groups through qualitative chemical analysis; correlation of the information obtained with the composition of the analyzed system
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	• Explanation and assimilation of the theoretical bases of analytical chemistry and the principles of analysis techniques and their use within the classical methods of identification and/or quantitative determination of some chemical species (components of the environment, raw materials, intermediate products, finished products and waste) with applications in the control of technological processes, product quality control and environmental protection.
7.2 Specific objectives	• Acquiring the theoretical notions of analytical chemistry, equilibria in solutions and the principles of qualitative chemical analysis • Training of practical skills regarding sampling and preparation of samples for analysis • Assimilation of theoretical notions and formation of practical skills to carry out the measurement operations necessary for analysis (weighing, volume measurements, pH measurement, preparation of solutions) • Performing the necessary operations for the identification of some chemical species from the samples by chemical methods

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
1. Introductory concepts: analytical chemistry and chemical analysis, stages of chemical analysis, electrolytes and non-electrolytes	2	Lecture, PPT presentations, conversations, examples, use of specific software, explanations, materials available in pdf format in the Virtual Campus
2. Solutions, concentrations, equilibrium constants: ways of expressing the concentration of solutions, equilibria in analytical chemistry, the influence of ionic strength and temperature on chemical equilibria	4	
3. Equilibria with proton transfer: acids, bases, acid-base distribution diagrams (calculation of relative proportions of species, equilibrium molar concentrations of species, average protonation number, graphical representations), calculation of pH of protolith solutions, systems pH buffer, applications of acid-base balances in chemical analysis	9	
4. Complexation equilibria: stability of complex combinations, distribution diagrams (calculation of relative proportions of species, equilibrium molar concentrations of species, average coordination number, graphical representations), competitive equilibria, conditional stability constants, applications of complexation equilibria in chemical analysis	5	
5. Equilibria with electron transfer: redox couples, oxidation, reduction, redox potentials, competitive equilibria, conditional redox potentials, applications of redox equilibria in chemical analysis	4	
6. Solubility equilibria: solubility, solubility calculation, competitive equilibria, conditional solubilities, applications of solubility equilibria in chemical analysis	4	

Bibliography [12]

1. D. Harvey, Modern Analytical Chemistry, McGraw-Hill, 2000.

2. L. Kekedy, Qualitative chemical analysis (Chimie analitică calitativă), Ed. Scrisul românesc, Craiova, 1982.
3. M. Pârlea, C. Muntean, Qualitative chemical analysis. Theoretical aspects (Chimie analitică calitativă. Aspecte teoretice), Ed. Eurobit, Timişoara, 2001.
4. C. Muntean, M. Stoia, I. Julean, Equilibria in aqueous solutions. Conditional constants – Principles. Numerical applications. Specific software (Echilibre în soluţie apoasă. Constante condiţionale - Principii. Aplicaţii numerice. Programe dedicate), Ed. Politehnica, Timişoara, 2012.
5. G.D. Christian, P.K. Dasgupta, K.A. Schug, Analytical Chemistry, 7th edition, Wiley, 2014

8.2 Applied activities [13]	Number of hours	Teaching methods
1. Taking samples and preparing them for analysis	2	Discussion of the theoretical aspects of the experiments, conversations, examples, use of specific software, explanations, experiments, materials available in pdf format and web page in the Virtual Campus
2. Preparation of solutions used in chemical analysis; Weighing and volume measurements	4	
3. pH measurement	2	
4. Analytical reactions, scale of chemical analysis, analytical groups; Identification of organic functional groups	4	
5. Separation and identification of cations from analytical groups I	4	

[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.).
[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".

and II		
6. Separation and identification of cations from analytical group III	4	
7. Separation and identification of cations from analytical groups IV and V	4	
8. Separation and identification of anionic species	4	
	4	

Bibliography [14]

1. C. Muntean, M. Stoia, I. Julean, Equilibria in aqueous solutions. Conditional constants – Principles. Numerical applications. Specific software (Echilibre în soluţie apoasă. Constante condiţionale - Principii. Aplicaţii numerice. Programe dedicate), Ed. Politehnica, Timişoara, 2012.
2. C. Muntean, A. Negrea, L. Lupa, M. Ciopec, Chemical and physico-chemical analysis with applications in environmental protection (Analiză chimică şi fizico-chimică cu aplicaţii în protecţia mediului), Ed. Politehnica, Timişoara, 2009.
3. M. Pârlea, C. Muntean, Qualitative chemical analysis (Chimie analitică calitativă), Ed. Eurobit, Timişoara, 2000.

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

- Knowledge of analysis methods and their use within the chemical analysis of some systems (environmental factors, raw materials, intermediate products, finished products, waste), performing chemical analysis, processing experimental data and interpreting analysis results, represent some of the main expectations of employers.

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Answering questions from the course topic	Written exam consisting of four parts (theoretical subjects and numerical applications), plus a starting point	66%
10.5 Applied activities	**S:**		
	L: Solving problems corresponding to experiments	Written tests from the theoretical aspects of the experiments, the appreciation of the way to participate in the laboratory activities, to train the skills of handling the equipment, processing the experimental data, and interpreting the obtained result.	20 %
	Homework	Presentation of solutions, answers to questions	7 %
	Attendance	Registration of attendance	7 %
	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])

- Exam - For each part, the student must achieve 50% of the score.
- Laboratory – The student must do all the experiments, hand in all the reports and homework.

Date of completion	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
	Conf.dr.ing. Cornelia MUNTEAN	Conf.dr.ing. Cornelia MUNTEAN, S.L.dr.ing. Laura COCHECI

Head of Department **Date of approval in the Faculty Council** [18] **Dean**

[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.

(signature)	**(signature)**
Conf.dr.ing. Andrea KELLENBERGER	Ș.L.dr.ing. Mircea Laurențiu DAN

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