SYLLABUS

1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty[1]/ Department [2]	Faculty of 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]	Physical chemistry II / DD						
2.2 Coordinator (holder) of course activities	S. L. Dr Ing. Erika REISZ.						
2.3 Coordinator (holder) of applied activities[5]	S. L. Dr Ing. Erika REISZ						
2.4 Year of study[6]	II	**2.5** Semester	4	**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	5.5 of which:	**3.2** course	2.5	**3.3** seminar / laboratory / project	1/2/0
3.1* Total number of fully assisted hours / semester	77 of which:	**3.2*** course	35	**3.3*** seminar / laboratory / project	14/28/0
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	5.21 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			1.5
		hours of individual study after manual, course support, bibliography and notes			1.85
		training seminars / laboratories, homework and papers, portfolios and essays			1.86
3.7* Number of hours of unassisted activities / semester	73 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			21
		hours of individual study after manual, course support, bibliography and notes			26
		training seminars / laboratories, homework and papers, portfolios and essays			26
3.8 Total hours / week [9]	10.71				
3.8* Total hours /semester	150				
3.9 Number of credits	6				

4. **Prerequisites** (where applicable)

4.1 Curriculum	• Mathematics, physics and analytical 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	• Notions of differential and integral calculus, thermodynamics and chemistry

5. Conditions (where applicable)

5.1 of the course	• Large classroom; • Supporting material - board
5.2 to conduct practical activities	• Seminar classroom • Physical chemistry laboratory

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	• Understanding the fundamental principles of physical chemistry and their application in the case of processes of industrial or practical interest •
7.2 Specific objectives	• Defining basic notions, concepts, theories and models in the field of chemistry and engineering and their appropriate use in professional communication • Using basic knowledge in the field of chemistry and chemical engineering to explain and interpret engineering phenomena • Identification and application of concepts, methods and theories for solving problems typical of chemical engineering in conditions of qualified assistance • Critical analysis and use of working principles, methods and techniques for quantitative and qualitative evaluation of chemical engineering processes • Application of fundamental concepts and theories in the field of chemistry and chemical engineering for the elaboration of professional projects • Monitoring the processes in the chemical industry, identifying abnormal situations and proposing solutions in conditions of qualified assistance • Critical evaluation of processes, equipment, procedures and products in the chemical industry using specific evaluation tools and methods • Elaboration of professional projects for technologies in the field of chemical engineering

	• Use of basic knowledge for mathematical modeling of processes of industrial relevance, including the use of software products specific to inorganic and depollution chemical technologies. Using mathematical models to design specific equipment • Comparative evaluation of the performances of some simple technological processes based on specific parameters

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
1. Thermodynamic potentials 2. Chemical potential. Dependence of chemical potential on pressure. Standard states	7	Lecture-debate, debate, demonstration, problematization, case study, brainstorming, methods and techniques of cooperative learning, etc
3. Chemical equilibrium 3.1 Overview. Characteristics and conditions of chemical equilibrium 3.2 Van't Hoff isotherm of reaction 3.3 Equilibrium constants. Relations among constants 3.4 Factors influencing chemical equilibrium. Le Chatelier Braun law	9	
4. Physical equilibria 4.1 Phase rule 4.2 Interphase equilibria in one-component systems 4.3 Biphasic equilibria in one-component systems. Clausius Clapeyron's law 4.4 Liquid-vapor equilibrium in systems consisting of a volatile solvent and a non-volatile solvate. Raoult's law 4.5 Ebulioscopy 4.6 Cryoscopy 4.7 Solubility of gases in liquids 4.8 Solubility of solids in liquids 4.9 Distribution equilibria. Nernst's law 4.10 Osmosis 4.11 Liquid-vapor equilibrium. Liquid-vapor equilibrium in ideal binary systems. The principle of distillation. Liquid-vapor equilibrium in non-ideal binary systems. Azeotropic mixtures 4.12 Liquid-solid equilibrium. Liquid-solid equilibrium in ideal binary systems. Liquid-solid equilibrium in non-ideal binary systems. Thermal analysis	19	

Bibliography [12]

1. Atkins, P. W., Tratat de chimie fizica, Editura Tehnica, Bucuresti, 1996;
2. Berry R. S., Rice S. A., Ross J., Physical Chemistry, Oxford University Press, New York – Oxford, 2000
3. Poraicu, M., Pacurariu, C., Davidescu, C. M., Chimie fizica, Litografia IPTVT, Timisoara, 1992;
4. Davidescu, C. M., Introducere in termodinamica chimica, Ed. Politehnica, Timisoara, 2018;
5. Tribunescu, P., Chimie fizica, vol. I, Litografia IPTVT, Timisoara, 1979;
6. Tribunescu, P., Chimie fizica, vol. II, Litografia IPTVT, Timisoara, 1981;

8.2 Applied activities [13]	Number of hours	Teaching methods

[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".

LABORATORY 1. Work safety 2. Chemical equilibrium in a homogeneous environment. Spectrophotometric determination of an equilibrium constant 3. Increase of the boiling temperature of solutions consisting of a volatile solvent and a non-volatile solvate relative to the boiling temperature of the pure solvent. Ebulioscopy 4. Liquid-liquid equilibrium in partial miscible systems. Ternar mixtures 5. Liquid-vapour equilibrium. Liquid-vapour equilibrium in non-ideal binary systems. Azeotropic mixtures 6. Liquid-solid equilibrium. Liquid-solid equilibrium in non-ideal binary systems. Thermal analysis 7. Make-up sessions	4 4 4 4 4 4 4	Written testing of students at the beginning of the laboratory session; discussing the theoretical aspects, the way of working and the processing of experimental data; the actual performance of the laboratory work; checking the results obtained and grading the students
SEMINAR 1. Entropy of reaction. Dependence of reaction entropy on temperature. 2. Gibbs energy. Calculation of Gibbs standard reaction energy. Dependence of reaction Gibbs energy on temperature 3. Equilibrium constants. Calculation methods. Influence of temperature and pressure on equilibrium constants.	3 3 8	Written testing of students at the beginning of the seminar, solving some problems (on the board)

Bibliography [14]

1. Ardelean, R., Reisz, E., Davidescu, C. M., Lucrari practice de chimie fizica, Editura Politehnica, Timisoara, 2018
2. Poraicu, M., Merca, E., Davidescu, C. M., Pacurariu, C., Parlea, G., Lucrari practice de chimie fizica, Litografia IPTVT, Timisoara, 1985

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 physical chemistry course offers students a set of notions and laws of nature as well as a network of their interconnections, necessary for the subsequent collaboration of the graduate with other engineers in the field.

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Master of basic notions in the field of physical chemistry. Ability to apply the notions taught in the course.	3-hour written exam, based on questions with different degrees of difficulty that assess students' thinking ability and a numerical application	66 %
10.5 Applied activities	**S:** Level of mastery of theoretical notions, the ability to solve problems and attendance at the seminar	Written test at the beginning of the seminar, answers to the questions asked during the seminar, solving a problem on the board and solving a problem in the exam	14 %
	L: Level of mastery of theoretical notions, the way the student works in the	Written test at the beginning of the laboratory session, answers to the questions asked during discussions regarding laboratory work	20 %

[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.)

	laboratory, the way of processing experimental data	and the way of processing experimental data	
	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 answers to the questions must accumulate at least 10 points out of 20 and solving the problem must add up to 5 out of 10 points.			

Date of completion	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
29.09.2024	S. L. Dr Ing. Erika REISZ	S. L. Dr Ing. Erika REISZ
Head of Department (signature)	**Date of approval in the Faculty Council** [18]	**Dean (signature)**
Conf.dr.ing. Andrea KELLENBERGER		S.L.dr.ing. Mircea DAN

[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.