

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	Chemical kinetics / DD						
2.2 Coordinator (holder) of course activities	Assoc. Prof. dr. eng. Lavinia LUPA						
2.3 Coordinator (holder) of applied activities ⁵	Assoc. Prof. dr. eng. Lavinia LUPA						
2.4 Year of study ⁶	III	2.5 Semester	5	2.6 Type of evaluation	E	2.7 Regime of discipline ⁷	DD

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	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
		training seminars / laboratories, homework and papers, portfolios and essays			1.14
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			14
		hours of individual study after manual, course support, bibliography and notes			14
		training seminars / laboratories, homework and papers, portfolios and essays			16
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	<ul style="list-style-type: none"> General chemistry, mathematics, physical chemistry
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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	•
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5. Conditions (where applicable)

5.1 of the course	• Lecture room with video projector and internet connection
5.2 to conduct practical activities	• Laboratory equipped for experiments appropriate to the program and the skills to be acquired

6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> • Definition of fundamental notions in the field of chemical kinetics and their use in professional communication • Using basic knowledge of chemical kinetics to explain and interpret engineering phenomena. Use of the most appropriate methods and working techniques for the evaluation of chemical engineering processes
Professional competencies ascribed to the specific competencies	<ul style="list-style-type: none"> • - 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	<ul style="list-style-type: none"> • Understanding the fundamentals of the dynamics of chemical transformations and their application to industrial chemical processes
7.2 Specific objectives	<ul style="list-style-type: none"> • Understanding the dynamics of the development of chemical processes, the factors that influence the rate of the chemical reaction and obtaining the desired products • Identifying, selecting and applying the most appropriate experimental techniques for the kinetic study of chemical reactions. • Selection of the most appropriate analytical methods for solving theoretical and practical problems. Formation of skills for choosing the optimal conditions for conducting chemical reactions. Using expert knowledge for experiment strategy. Explanation and interpretation of experimental results

8. Content ¹⁰

8.1 Course	Number of hours	Teaching methods ¹¹
1. Fundamentals of Chemical Kinetics. Reaction rate. Ways of	3	Lecture containing

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.).

expressing rate of reactions. Reaction order. Reaction mechanism. Molecularity		explanations, discussions, demonstrations and examples
2. Kinetics of simple reactions in closed homogeneous systems. Zero, one, two, fractional and higher order reactions	5	
3. Methods for determining the order of reaction. The integral method. The differential method. Fractional time method.	3	
4. Experimental techniques used in chemical kinetics	2	
5. Kinetics of reactions in dynamic systems. Tubular reactor. The reactor with perfect stirring	2	
6. The influence of temperature on the reaction rate. Arrhenius equation. Anti Arrhenius reactions	2	
7. Kinetics of complex reactions. Parallel reactions. Opposite or equilibrium reactions. Consecutive or successive reactions. Chain reactions.	6	
8. Kinetics of reactions in solution. Solvent effect on reactions between neutral molecules. Solvent effect on reactions between ions. Influence of ionic strength. Salt effect	3	
9. Kinetics of catalytic reactions. Homogeneous, enzymatic and heterogeneous catalysis	2	
Bibliography ¹² C. Pacurariu, Cînetică chimică, Ed. POLITEHNICA Timișoara, 2003; R. I. Masel, Chemical kinetics and catalysis, John Wiley&Sons, 2001, New York; P. Atkins, C. Trapp, M. Cady, C. Giunta, Physical chemistry, eight ed. Oxford Univ. Press, 2006, New York; K. T. Valsaraj, Elements of environmental engineering. Thermodynamics and kinetics, sec. Ed. Lewis Publishers, 2000, New York; L. Lupa, L. Cochechi, R. Pode, I. Hulka, Phenol adsorption using Aliquat 336 functionalized Zn-Al layered double hydroxide, Separation and Purification Technology 196, 82-95, 2018; L Lupa, A Negrea, M Ciopec, P Negrea, R Vodă, Ionic liquids impregnated onto inorganic support used for thallium adsorption from aqueous solutions, Separation and purification technology 155, 75-82, 2015		
8.2 Applied activities ¹³	Number of hours	Teaching methods
1. Decomposition of hydrogen peroxide in homogeneous catalysis	4	The experimental method. The method of practical works. Computer-assisted training
2. Decomposition of the oxalo-manganese complex	4	
3. Sucrose hydrolysis in acid catalysis. Determination of the activation energy	4	
4. Primary saline effect	4	
5. Alkaline hydrolysis of ethyl acetate	4	
6. The reaction of hydrogen peroxide with alkaline iodides	4	
7. Verification and testing of the knowledge acquired during laboratory activity	4	
Bibliography ¹⁴ C. Pacurariu, C. Davidescu, M. Poraicu, E. Reisz, Cînetică chimică și chimie coloidală-Lucrări practice, Litografia Univ. Politehnica Timisoara, 2002; C. Pacurariu, Cînetică chimică, Ed. POLITEHNICA Timișoara, 2003 . Cornelia Muntean, Adina Negrea, Lavinia Lupa, Mihaela Ciopec, Analiză chimică și fizico-chimică cu aplicații în protecția mediului, Editura Politehnica Timișoara, ISBN: 978-973-625-973-9, 220 pagini, 2009		

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 with similar disciplines in the country and abroad, as well as with the expectations of professional associations and representative employers in the field

10. Evaluation

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".

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

Type of activity	10.1 Evaluation criteria ¹⁵	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Knowledge of the basic concepts in the field of chemical kinetics. Ability to apply the concepts taught in the course in practice	3-hour written exam based on questions of varying difficulty that assess students' thinking ability and a numerical application	66%
10.5 Applied activities	S:		
	L: Ability to work in a team. The ability to process experimental data and how to present the report. Seriousness, punctuality	References with experimental results, mathematical processing of data and interpretation of results. Noting how to solve problems received as homework. Check test at the end of the semester	34%
	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)			
<ul style="list-style-type: none"> Demonstration of competence regarding the selection of the most appropriate analytical methods for solving theoretical and practical problems of chemical kinetics. Completion of the laboratory activity with a minimum grade of 5 			

Date of completion

**Course coordinator
(signature)**

Assoc. Prof. dr. eng. Lavinia LUPA

**Coordinator of applied activities
(signature)**

Assoc. Prof. dr. eng. Lavinia LUPA

**Head of Department
(signature)**

Conf.dr.ing. Andrea
KELLENBERGER

Date of approval in the Faculty Council ¹⁸

**Dean
(signature)**

Ș.L.dr.ing. Mircea Laurențiu DAN

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.