

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 +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	Dyes and Pigments / DS						
2.2 Coordinator (holder) of course activities	Conf.dr.ing. Simona POPA / Conf.dr.ing. Radu LAZĂU						
2.3 Coordinator (holder) of applied activities ⁵	Conf.dr.ing. Simona POPA / Conf.dr.ing. Radu LAZĂU						
2.4 Year of study ⁶	III	2.5 Semester	6	2.6 Type of evaluation	E	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	5 of which:	3.2 course	2.5	3.3 seminar / laboratory / project	0/2.5/0
3.1* Total number of fully assisted hours / semester	70 of which:	3.2* course	35	3.3* seminar / laboratory / project	0/3.5/0
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	0.36 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0,1
		hours of individual study after manual, course support, bibliography and notes			0,1
		training seminars / laboratories, homework and papers, portfolios and essays			0.16
3.7* Number of hours of unassisted activities / semester	5 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			1,4
		hours of individual study after manual, course support, bibliography and notes			1,4
		training seminars / laboratories, homework and papers, portfolios and essays			2,24
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	Organic chemistry; Analytical 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.

	<ul style="list-style-type: none"> • Materials science; Solid state physical chemistry
4.2 Competencies	<ul style="list-style-type: none"> • Assembling and handling a laboratory installation • Team work

5. Conditions (where applicable)

5.1 of the course	Lecture hall equipped with video projector and blackboard
5.2 to conduct practical activities	Appropriately equipped laboratory room

6. Specific competencies acquired through this discipline

Specific competencies	<p>Understanding the knowledge regarding the relationships between the structure and color of organic compounds</p> <p>Theoretical syntheses of dyes from various classes starting from a given raw material</p> <ul style="list-style-type: none"> • Dyeing textile supports with dyes from various classes • Chromatographic and spectrophotometric analyzes - use of specific equipment • Understanding the mechanisms leading to the appearance of color in inorganic compounds containing transition metal cations • Understanding the correlation between the composition of the raw materials, the manufacturing method and the characteristics of the obtained inorganic pigments • Optimal choice of inorganic pigments in accordance with their field of use
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	<p>The aim of the discipline is for students to acquire knowledge regarding the relationships between the structure and color of organic compounds, the characterization of chromophore groups, the classification of organic dyes into different categories, the technologies for obtaining these dyes, their characterization, the application of dyes on different supports and their characterization.</p> <ul style="list-style-type: none"> • Transmission of knowledge on the structure and properties of heat-resistant pigments, synthesis methods and their applications, based on modern concepts in the field.
7.2 Specific objectives	<p>Getting used to assembling a chemical installation, dyeing various textile supports, using spectrophotometric analysis equipment</p> <ul style="list-style-type: none"> • Competence formation regarding the synthesis, characterization and choice of the most suitable structures for heat-resistant pigments, in correlation with specific applications.

8. Content ¹⁰

8.1 Course	Number of hours	Teaching methods ¹¹
Raw materials for the synthesis of aromatic intermediates. Notions about the synthesis of aromatic intermediates	5	Interactive course using modern presentation methods Lecture Conversation Problematization Case study
Relationships between the structure and color of organic compounds. The notion of color, the mutual influence of auxochromic and antiauxochromic groups. Characterization of chromophore groups	4	
Classification of organic dyes. Azo dyes	5	
Characterization of textile fibers and dyeing processes. Cellulosic fibers. Protein fibers. Structure, properties. Preliminary treatments painting, painting and finishing	3.5	
General definitions and properties. Meaning of the terms pigment and colorant. Classification of pigments. Physical characteristics of inorganic pigments. Color and high temperature resistance.	5	
Composition-structure-property relationship in inorganic pigments chemistry. The origin of color. Isomorphy relations in different oxide systems. Isomorphic substitution in the crystalline lattice.	5	
Common structural types of heat-resistant pigments: spinel, baddeleyite and zircon, tin sphene, perovskite. Synthesis methods.	5	
Pigments with special properties: phosphorescent pigments and "cool" pigments with high near-infrared reflection.	2,5	
Bibliography ¹²		
1. L.Floru, F.Urseanu, C.Tarabaşanu, R.Palea, <i>Chimia și tehnologia intermediarilor aromatici și a coloranților organici</i> ; Ed.Did.si Ped., Bucureşti, 1980		
2. F.W.Billmeyer, Jr., M.Saltzman, <i>Principles of Colour Technology</i> , John Wiley & Sons, New York, 1981		
3. Simona Popa, D.Jurcău, Carmen Jurcău, Nicoleta Pleşu, <i>Pigmenți organici. Vol.I. Pigmenții și culoarea</i> , Ed. Orizonturi Universitare, Timișoara, 2005		
4. Simona Popa, D.Jurcău, Nicoleta Pleşu, <i>Pigmenți organici. Vol.II</i> , Ed. Eurostampa, Timișoara, 2008		
5. Simona Popa, <i>Fundamente și aplicații pentru industria de sinteză organică fină și de procesare a produselor naturale</i> , vol.I,II, Ed. Politehnica, Timișoara, 2012-2013		
6. A.T. Balaban, M. Banciu, I. Pogany, <i>Aplicații ale metodelor fizice în chimia organică</i> , Ed. Științifică și Enciclopedică, București, 1983		
7. Simona Popa, <i>Organic dyes. Student book</i> , Ed. Politehnica, Timișoara, 2021		
8. N. Orban – Pigmenți anorganici, Ed. Tehnică, Bucuresti 1974.		
9. R. Lazău - Studii asupra parametrilor care influențează culoarea glazurilor ceramice cu ioni tranziționali, Teză de doctorat, Editura Politehnica, 2007.		
10. R. Lazău - Ghid de aplicații practice și probleme pentru tehnologia ceramicii, Editura Politehnica, 2008.		
11. I. Lazău, C. Păcurariu, R. Ianos, R. Lazău, S. Borcănescu - Metode moderne de analiză și caracterizare a micro și nanomaterialelor, Ed. Politehnica, 2012.		
12. R. Lazău, R. Ianos – Materiale multifuncționale inteligente, Ed. Politehnica, 2013.		
13. E. Temple, C. Patton – Pigment Handbook, Wiley, New York, 1975.		
14. M. Swain – Materials science and technology, Structure and properties of ceramics, Vol. 11, VCH, 1994.		

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.

8.2 Applied activities ¹³	Number of hours	Teaching methods
Introduction to the Dyes laboratory in the organic chemical industry. General and specific OSH and SU rules	1.5	Participatory lecture; Carrying out laboratory works, studying and interpreting the results, solving problems, debating
Color analysis of some organic dyes	5	
Tinctorial applications on various textile supports	6	
Chromatographic and spectrophotometric analyzes of azo dyes	5	
Synthesis of pigments with spinel structure by the solid state reaction method	4	
Synthesis of phosphorescent pigments by the sol-gel method	4	
Synthesis of different pigments by the combustion method	4	
Colorimetric and phase composition characterization of the obtained pigments, comparison between the synthesis methods used.	4	
Testing pigments obtained in ceramic glazes and acrylic/alkydic paints.	1,5	

Bibliography ¹⁴

1. Palea R., Boc I., Dăescu C., *Lucrări practice la tehnologia intermediarilor și coloranților organici*, Lito IPT, Timișoara, 1977
2. Simona Popa, *Fundamente și aplicații pentru industria de sinteză organică fină și de procesare a produselor naturale*, vol.I,II, Ed. Politehnica, Timișoara, 2012-2013
3. Popa S., Stanoiev Z., *Principii și fundamente de proiectare a compușilor chimici organici finiti*, Ed. Politehnica, 2013
4. A.T. Balaban, M. Banciu, I. Pogany, *Aplicații ale metodelor fizice în chimia organică*, Ed. Științifică și Enciclopedică, București, 1983
5. Simona Popa, *Organic dyes. Student book*, Ed. Politehnica, Timișoara, 2021
6. N. Orban – *Pigmenți anorganici*, Ed. Tehnică, Bucuresti 1974.
7. R. Lazău - *Studii asupra parametrilor care influențează culoarea glazurilor ceramice cu ioni tranziționali*, Teză de doctorat, Editura Politehnica, 2007.
8. R. Lazău - *Ghid de aplicații practice și probleme pentru tehnologia ceramicii*, Editura Politehnica, 2008.
9. I. Lazău, C. Păcurariu, R. Ianos, R. Lazău, S. Borcănescu - *Metode moderne de analiză și caracterizare a micro și nanomaterialelor*, Ed. Politehnica, 2012.
10. R. Lazău, R. Ianos – *Materiale multifuncționale inteligente*, Ed. Politehnica, 2013.
11. E. Temple, C. Patton – *Pigment Handbook*, Wiley, New York, 1975.
12. M. Swain – *Materials science and technology, Structure and properties of ceramics*, Vol. 11, VCH, 1994.

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 consistent with what is done in other university centers in the country and abroad. For a better adaptation to the demands of the labor market of the content of the discipline, study visits to industrial units take place

10. Evaluation

Type of activity	10.1 Evaluation criteria ¹⁵	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Part I: - correctness and completeness knowledge; - logical coherence; - degree of assimilation a the language of specialty; - targeting criteria attitudinal aspects:	Part I: Written exam, testing the knowledge presented in the course and description of the main theoretical stages of the synthesis of a dye. The weighted average is calculated only if the student proves sufficient minimum knowledge in the written exam. For grade 5, the student must know the fundamental elements of theory and briefly describe the synthesis of the dye in question. To obtain	0,66

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.

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.)

	<p>conscientiousness, interest in study individual</p> <p>Part II:</p> <ul style="list-style-type: none"> - completeness and correctness of knowledge; - logical coherence, fluency, expressiveness, the force of argumentation; - ability to operate with assimilated knowledge in complex intellectual activities 	<p>grade 10, the student must prove in-depth knowledge and the ability to correctly apply the assimilated knowledge. The student must highlight the essential aspects and show that he has not mastered them mechanically, as well as the description of the dye synthesis reactions in question, including the conditions for their development</p> <p>Part II:</p> <p>Written exam, 3 hours, 4 subjects OR Online multiple choice test on the UPT Virtual Campus platform</p>	
10.5 Applied activities	S:		
	<p>L: Part I: Execution of laboratory works. Doing homework</p> <p>Part II:</p> <ul style="list-style-type: none"> - analytic capacity, personal interpretation, originality, creativity; - the ability to work in a team - synthesis capacity and interpretation of experimental data 	<p>Part I: The method of carrying out the laboratory works and the interpretation of the obtained results are evaluated in a continuous manner. For grade 5, the student must perform the laboratory work and interpret the experimental data at a basic level. For grade 10, the student must actively participate in laboratory work, solve problems, answer questions and interpret the obtained data independently, correctly and completely</p> <p>Part II: Laboratory reports, Final test to verify practical knowledge</p>	0,34
	P¹⁶:		
	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"> • Knowledge of the fundamental elements of theory 			

Date of completion

**Course coordinator
(signature)**

**Coordinator of applied activities
(signature)**

Conf.habil.dr.ing. Simona POPA

Conf.habil.dr.ing. Simona POPA

Conf.dr.ing. Radu LAZĂU

Conf.dr.ing. Radu LAZĂU

**Head of Department
(signature)**

Date of approval in the Faculty Council ¹⁸

**Dean
(signature)**

S.L.dr.ing. Andra TĂMAȘ
Conf.dr.ing. Andrea
KELLENBERGER

Ș.L.dr.ing. Mircea Laurențiu 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.