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 Envionmental 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 / .....

2. Information about the discipline

2.1 Name of discipline/ formative category[4]			Conventional and advanced oxide materials / DS				
2.2 Coordinator (holder) of course activities			Prof. dr. ing. Robert IANOȘ				
2.3 Coordinator (holder) of applied activities[5]			Prof. dr. ing. Robert IANOȘ				
2.4 Year of study[6]	III	**2.5** Semester	5	**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			0.56
		hours of individual study after manual, course support, bibliography and notes			0.4
		training seminars / laboratories, homework and papers, portfolios and essays			0.4
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			7.84
		hours of individual study after manual, course support, bibliography and notes			5.6
		training seminars / laboratories, homework and papers, portfolios and essays			5.6
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	• The classroom is equipped with a video projector and whiteboard. • During the course classes, students may use the phone for teaching purposes only.
5.2 to conduct practical activities	• During practical activity classes, students may use the phone for teaching purposes only.

6. Specific competencies acquired through this discipline

Specific competencies	• The ability to understand the behavior of conventional and advanced oxide materials considering the dependence of properties on the structure, chemical composition and particle size. • The ability to adjust the properties of conventional and advanced oxide materials by rationally changing the: chemical composition, structure, specific surface area, heat treatments.
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	• Conveying essential knowledge on conventional and advanced oxide materials, based on current concepts and theories in the field, correlated with labor market requirements.
7.2 Specific objectives	• Formation of competencies in the field of understanding and use of the properties shown by conventional and advanced oxide materials.

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
1. Definition of oxide materials and their classification. Structure of oxide materials. Coordination polyhedra. Unit cell.	2	Lecture, problematization, conversation, case study, Virtual Campus
2. Assessment of the phase (mineralogical) composition of oxide materials. Calculation of crystallite size and lattice parameters.	2	
3. The role of the specific surface area in obtaining oxide materials and exploiting their properties. Peculiarities of solid-state reactions.	2	
4. Conventional oxide materials: lime. Obtaining, properties, applications.	2	
5. Conventional oxide materials: bricks and tiles. Obtaining, properties, applications.	2	
6. Conventional oxide materials: Portland cement and concrete.	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.).

Obtaining, properties, applications.		
7. Conventional oxide materials: glass and glass-ceramic. Obtaining, properties, applications.	2	
8. Advanced oxide materials: nanoparticles / nanofilms / nanomembranes. Obtaining, properties and applications	4	
9. Advanced Oxide Materials: ferrites and high temperature superconductors. Obtaining, properties, applications.	4	
10. Advanced Oxide Materials: biomaterials. Properties, applications.	2	
11. Advantages of using the solution combustion synthesis for the preparation of conventional and advanced oxide materials.	2	

Bibliography [12]

1. R.I. Lazău, R. Ianoș: Materiale multifuncționale inteligente, Editura Politehnica Timișoara, 2013.
2. I. Lazău, C. Păcurariu, Z. Ecsedi, R. Ianoş, Metode neconvenționale utilizate în sinteza compușilor oxidici, Editura Politehnica Timişoara, 2006.
3. R.B. Heimann, Classic and Advanced Ceramics – from fundamentals to applications, Wiley-VCH, 2010.
4. P.M. Woodward, P. Karen, J.S.O. Evans, T. Vogt, Solid State Materials Chemistry, Cambridge University Press, 2021.
5. E.A. Moore, L.E. Smart, Solid State Chemistry An Introduction, CRC Press, 2020.

8.2 Applied activities [13]	Number of hours	Teaching methods
1. The assessment of phase composition of oxide materials by X-ray powder diffraction. Calculation of crystallite size, unit cell parameters and theoretical density.	4	The experimental method, Method of practical works, Computer-assisted instruction, Virtual Campus
2. Acceleration of solid-state reactions using the solution combustion route for the preparation of conventional and advanced oxide materials.	4	
3. Densification (sintering) of conventional and advanced oxide materials. Case studies: bricks, tiles, clinker, $LiMgPO_4$, $CoFe_2O_4$, $YBa_2Cu_3O_7$.	4	
4. Preparation and characterization of some oxide materials with controlled porosity: ceramic foams, expanded glass. Determination of compactness indices.	4	
5. Hydraulic properties of Portland cement. Setting time accelerators and retardants. Concretes.	4	
6. Optical properties of calcium aluminates doped with Ni^{2+}. Cool coatings	4	
7. Preparation and stabilization of Fe_3O_4 nanoparticles. Ferrofluids.	4	

Bibliography [14]

1. R.I. Lazău, R. Ianoș: Materiale multifuncționale inteligente, Editura Politehnica Timișoara, 2013.
2. I. Lazău, C. Păcurariu, R. Ianoş, R.I. Lazău, S. Borcănescu – Metode moderne de analiză şi caracterizare a micro şi nanomaterialelor, Editura Politehnica Timişoara, 2012.
3. I. Lazău, C. Păcurariu, Z. Ecsedi, R. Ianoş, Metode neconvenționale utilizate în sinteza compușilor oxidici, Editura Politehnica Timişoara, 2006.
4. R.B. Heimann, Classic and Advanced Ceramics – from fundamentals to applications, Wiley-VCH, 2010.
5. P.M. Woodward, P. Karen, J.S.O. Evans, T. Vogt, Solid State Materials Chemistry, Cambridge University Press, 2021.
6. E.A. Moore, L.E. Smart, Solid State Chemistry An Introduction, CRC Press, 2020.

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

[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.

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Knowledge of basic terminology, typical for this discipline. The ability to apply the learned information.	Written exam lasting 2 hours, 4 subjects with different difficulty level.	66 %
10.5 Applied activities	**S:**		
	L: Ability to perform teamwork and individual work. Correct and timely resolution of assigned tasks. Seriousness, punctuality	Verification test at the end of the semester. The subjects are formulated based on the applied activities previously conducted.	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])			
• Grade 5. Demonstrating the ability to explain and correlate the properties of conventional and advanced oxide materials with their structure and chemical composition.			

Date of completion	**Course coordinator (signature)** Prof.dr.ing. Robert IANOȘ	**Coordinator of applied activities (signature)** Prof.dr.ing. Robert IANOȘ
Head of Department (signature) Conf.dr.ing. Andrea KELLENBERGER	**Date of approval in the Faculty Council** [18]	**Dean (signature)** Ș.l.dr.ing. Mircea 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.