SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş–Bolyai University of Cluj–Napoca
1.2 Faculty	Chemistry and Chemical Engineering
1.3 Department	Chemical Engineering
1.4 Field of study	Chemical Engineering
1.5 Study cycle	Master
1.6 Study programme / Qualification	Advanced Chemical Process Engineering

2. Information regarding the discipline

2.1 Name of the discipline	**Ceramics, binders and vitreous materials and advanced proccesing methods – CME7134**						
2.2 Course coordinator	Lect. dr. ing. Liliana BIZO						
2.3 Seminar coordinator	Lect. dr. ing. Liliana BIZO						
2.4 Year of study	2	2.5 Semester	3	2.6 Type of evaluation	E	2.7 Type of discipline	Comp.

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 laboratory	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 laboratory	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					40
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					30
Tutorship					5
Evaluations					3
Other activities:					

3.7 Total individual study hours	108
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	-
4.2. competencies	-

5. Conditions (if necessary)

5.1. for the course	• Students should switch off the mobile phones during courses and seminars. • Students should be present at the courses without any time delay.
5.2. for the seminar /lab activities	• The deadline for presenting the homework results will be agreed between the seminar holder and the students. No delay is accepted for the presentation of the homework results unless well-founded reasons

	are proven. • In case of presenting the homework with delay, the grade will be penalized by 0.5 points/ week of delay. • Students should be present at the seminars without any time delay.

6. Specific competencies acquired

Professional competencies	• Defining the language and identification of advanced concepts for advanced materials realisation • Explaining and understanding operation of specific devices, equipments and processes for the production of advanced materials • Conducting a extensive bibliographic study related to the research topic chosen, organizing and synthesizing of data with aquiring specific terminology; general and specific knowledge of research methods • Use specialized knowledge to establish research strategy, realization of experiments and interpretation of results • Using conceptual and methodological research for new theoretical approaches in synthesis of materials • Selecting and using appropriate research methods for a correct interpretation of the results and formulation of pertinent conclusions • Using the basic and applicative concepts in the development of research projects
Transversal competencies	• Performing research and design activities in a autonomous way, using specific equipments (included computer aided techniques) and conforming to the ethical rules • Developing of self guided evaluation of own professional performance and self assessment of the needs for continuous professional improvement based on permanent knowledge update related to his/her activity field • Communicating the own points of view, in a clear and concise way, using communication means based on conventional and non-conventional information technology instruments

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To familiarize students with the basic concepts, theories and models of the advanced oxide materials
7.2 Specific objective of the discipline	• Providing the basic information regarding the synthesis and advanced processing methods of some special ceramics, binders and vitreous materials • Acquiring knowledge on the composition, microstructure, advanced processing methods in correlation with the function of using the oxide materials

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. High reliability ceramics. Processing methods,	Lecture giving,	

densification concepts, colloidal powder processing. Silicon nitride powders. Powder Synthesis and Characterization. Powder Dispersion. Surface properties. Powder sintering. Ceramic Properties.	explanation, conversation, exemplification, debate	
8.1.2. Stabilised zirconia ceramics. Wet processing. Microstructure. Forming. Thermal treatment. Properties. Structural ceramics. Thin films – deposition methods.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.3. Electronic ceramics. Processing. Wet Forming. Slip Casting. Thermal treatment. Properties. Microwave processing of ceramics.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.4. Ceramic composites. Microstructure and processing. Sintering and Hot Forming. Reaction Processing. Melt Processing Methods. Chemical Vapour Deposition.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.5. Oxide-salt-water binders. A. Binders in system $MgO-MgCl_2(MgSO_4)-H_2O$. Phase equilibria, compositions, characteristics. B. Binders analogous to Sorel cement. Alkaline–earth and with other cationic elements binding systems.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.6. Oxide-acid-water binders. A. Phosphate binders. Phase equilibria. Reaction products. Hardening mechanism. B. Biocements. Types (calcium-phosphate, zinc-phosphate dental cement, magnesite-phosphate and silicate-phosphate).	Lecture giving, explanation, conversation, exemplification, debate	
8.1.7. Binders for high temperatures (refractories). Aluminate-phosphate, magnesite-phosphate and chromo-phosphate binders. Compositions. Characteristics. Obtaining methods.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.8. Oxide vitreous materials. Characterization of the vitreous structure. Oxides role in obtaining of the vitreous structure.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.9. Correlation composition-structure-properties. Silica glasses. Borate glasses. Phosphate glasses.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.10. Technical glasses. Chemical and thermal resistant glasses. Electrical glasses. Vycor glasses. Semiconducting glasses. Isolating glasses.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.11. Technical glasses. Optical and selective absorption glasses. Optical and selective absorption glasses characteristics. Photosensitive glasses characteristics. Optical fibers.	Lecture giving, explanation, conversation, exemplification,	

	debate	
8.1.12. Vitreous ceramics materials: oxide base systems, calculation of the glasses compositions (criteria), physical–chemical processes (homogeneous of melts, nucleating and growing of crystals, types of nucleates).	Lecture giving, explanation, conversation, exemplification, debate	
8.1.13. Vitreous ceramics materials obtaining: compositions, diagrams, properties, thermal treatment of melting and crystallization, materials characterization.	Lecture giving, explanation, conversation, exemplification, debate	
8.1.14. Vitreous biomaterials. Biological glasses with controlled corrosion. Radio therapy glasses. Vitreous ceramics for hyperthermia.	Lecture giving, explanation, conversation, exemplification, debate	

Bibliography

1. I. Teoreanu, *Bazele tehnologiei lianţilor anorganici*, Ed. Did. şi Pedag., Bucureşti, 1993, BCU.
2. D. Vasilescu, *Tehnologia lianţilor anorganici,* UBB, Cluj-Napoca, 2000, Biblioteca Facultății de Chimie.
3. P. Balta, *Tehnologia sticlei,* Editura Didactica si Pedagogica, Bucuresti, 1984, BCU, Biblioteca Facultății de Chimie.
4. F. Goga, *Tehnici de analiza a materialelor oxidice,* Presa Universitară Clujeană, 2006, Biblioteca Facultății de Chimie.

8.2 Seminar / laboratory	Teaching methods	Remarks
8.2.1. Presentation and discussion of experimental works. Work protection rules.	Conversation method, learning by discovery, individual learning, team working	
8.2.2. Colloidal powders processing	Conversation method, learning by discovery, individual learning, team working	
8.2.3. Stabilized zirconia and thin coating deposition method	Conversation method, learning by discovery, individual learning, team working	
8.2.4. Microwave processing of electronic ceramics	Conversation method, learning by discovery, individual learning, team working	
8.2.5. Sintering and hot pressing of ceramic composite	Conversation method, learning by discovery, individual learning, team working	
8.2.6. Physical and chemical deposition of thin films	Conversation method, learning by discovery, individual learning, team working	
8.2.7. Burning method for obtaining of binders	Conversation method, learning by discovery, individual learning, team working	
8.2.8. Theoretical method for properties prediction of vitreous materials	Conversation method, learning by discovery,	

	individual learning, team working	
8.2.9. Projecting composition and raw materials recipe for special glasses	Conversation method, learning by discovery, individual learning, team working	
8.2.10. Study of the melting processes in borate-silicate glasses	Conversation method, learning by discovery, individual learning, team working	
8.2.11. Synthesis of low melting glasses	Conversation method, learning by discovery, individual learning, team working	
8.2.12. Synthesis of colored glasses. Color characterization by dominant wavelength determination	Conversation method, learning by discovery, individual learning, team working	
8.2.13. Synthesis of crystallized glasses	Conversation method, learning by discovery, individual learning, team working	
8.2.14. Thermal analyses of crystallized glasses: Tg temperature, crystallization interval, melting point of new crystals	Conversation method, learning by discovery, individual learning, team working	
Bibliography 1. L. Gagea, *CERAMICĂ de laborator. Lucrări şi probleme*, Casa Cărţii de Ştiinţă, Cluj-Napoca, 2003, BCU, Biblioteca Facultăţii de Chimie, Biblioteca Departamentului de Inginerie Chimică. 2. F. Goga, *Tehnici de analiză a materialelor oxidice*, Editura Presa Universitară Clujeană, 2006, Biblioteca Biblioteca Facultăţii de Chimie.		

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

Feedback from industry (Companies: Saint Gobain, HOLCIM) has been used to comply with the expected competencies desired by potential employers.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	The correctness of answers - assimilation and understanding of the issues treated in class	Written examination. Access to examination is conditioned by the presentation of the prepared homework results. The fraud is punished by expelled from the exam according the ECTS regulations	70 %
	The ability to particulate the overall phenomena to a specific product		

10.5 Seminar/lab activities	The correctness of answers - assimilation and understanding of the issues treated to the laboratory	The solutions of the homework problems should be presented at the next laboratory/seminar meeting Labratory works corresponding to lab activities are delivered in the last week of teaching activity Laboratory exam will take place in the last week of teaching activity	30 %
	The quality of the laboratory works prepared		
	The activity carried out in the laboratory		
10.6 Minimum performance standards			
Minimum condition for exam promoting: 5 grade at laboratory exam and 5 grade at written examination. Knowledge of basic concepts , composition and microstructure of a oxidic product, main technological parameters, elaboration of a technologic flow for an advanced material with main stages, correlation of propertis and fuction of use.			

Date | Signature of course coordinator | Signature of seminar coordinat

30.03.2017

Date of approval | Signature of the head of department

31.03.2017