SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University, Cluj-Napoca
1.2 Faculty	Chemistry and Chemical Engineering
1.3 Department	Hungarian Department of Chemistry and Chemical Engineering
1.4 Field of study	Chemical Engineering
1.5 Study cycle	Master
1.6 Study program / Qualification	Chemistry and engineering of nano- and biomaterials

2. Information regarding the discipline

2.1 Name of the discipline	**Biocompatible materials – CME 8212**						
2.2 Course coordinator	Prof. dr. ing. BARABÁS Réka						
2.3 Seminar coordinator	Prof. dr. ing. BARABÁS Réka						
2.4 Year of study	I	2.5 Semester	1	2.6. Type of evaluation	E	2.7 Discipline regime	Compulsory

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28

Time allotment:	Hours
Learning using manual, course support, bibliography, course notes	20
Additional documentation (in libraries, on electronic platforms, field documentation)	20
Preparation for seminars/labs, homework, papers, portfolios and essays	20
Tutorship	6
Evaluations	3
Other activities:	-

3.7 Total individual study hours	69
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1 curriculum	• not necessary
4.2 competencies	• not necessary

5. Prerequisites (if necessary)

5.1. for the course	• Lecture room with video projector and internet
5.2. for the seminar /lab activities	• Deadline for the proceedings about the lab-works are 2 weeks • Students should be present in the labs without any time delay • 90% of lab hours are compulsory • Students should wear capes • Students should not leave any equipment without supervision • Eating and drinking is not allowed in the laboratories

6. Specific competencies acquired

Professional competencies	• Basic knowledges regarding colloid systems and application of nanotechnologies • Understanding the basic laws of thermodynamics
Transversal competencies	• Performing research and design activities in an autonomous way, using 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, concisely, 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	Acquirement from the students of some basic knowledges regarding the: • Preparation of nanomaterials • Characterization of nanomaterials • Fundamentals of nanotechnologies
7.2 Specific objective of the discipline	2 basic praparation methods of nanomaterials - "top down" methods - „bottom up" methods

8. Content

8.1 Lecture	**Teaching methods**	Remarks
1. Week: Introduction. Basic concepts. Short history. .	Lecture. Explanation. Conversation. Description.	
2. Week: General presentation of the preparation methods. Chemical methods. Homogenous nucleation. Precipitation	Lecture. Explanation. Conversation. Description. Discussion	
3. Week : Crystalization. Kinetics and mechanism of crystallization	Lecture. Explanation. Conversation. Description. Discussion	
4. Week: Preparation of nanomaterials from solutions. Additives. Preparation of metalic nanomaterials. Semiconductors	Lecture. Explanation. Conversation. Description. Discussion	
5. Week: Sol-gel method. Hidrolyzation. Rections in gas phase. Heterogenous nucleation	Lecture. Explanation. Conversation. Description. Discussion	
6. Week: Syntheses using steric hindrance. Syntheses from microemulsion. Aerosols. Pirolyses. One dimensional nanostructures. Electrospinning. Evaporation-condensation	Lecture. Explanation. Conversation. Description. Discussion	
7. Week: Evaporation-condensation. Mecanism VLS (vapor-liquid-solide) mecanism.	Lecture. Explanation. Conversation. Description. Discussion	
8. Week: Electrochemical methods. Electrophoresis. Zeta potenial.	Lecture. Explanation. Conversation. Description. Discussion	
9. Week: Template syntheses. Chemical Vapor Deposition (CVD). Characterization of nanomaterials	Lecture. Explanation. Conversation. Description. Discussion	
10. Week: Deposition methods of nanomaterials	Lecture. Explanation. Conversation. Description. Discussion	
10. Week: Advanced characterizations methods of bionanomaterials	Lecture. Explanation. Conversation. Description. Discussion	

11. Week : **Methods for determination of particle size distribution**	Lecture. Explanation. Conversation. Description. Discussion	
13. Week: AFM, SEM, TEM	Lecture. Explanation. Conversation. Description. Discussion	
14. Week: EDAX, RX, IR. Summary of the knowledges. Discutions.	Lecture. Explanation. Conversation. Description. Discussion	

Bibliografy:

1. G. B. Sergeev: Nanochemistry, Elsevier science & technology, 2006
2. W. R. Fahrner: Nanotechnology and Nanoelectronics, Springer-Verlag Berlin Heidelberg, 2005
3. C. Bréchignac, P. Houdy, M. Lahmani: Nanomaterials and Nanochemistry, Springer-Verlag Berlin Heidelberg, 2007
4. K. Ohno, M. Tanaka, J. Takeda, Y. Kawazoe: Nano- and Micromaterials Springer, Heidelberg, 2008
5. M. Di Ventra, S. Evoy, J. r. Heflin: Introduction to Nanoscale Science and Technology, Kluwer Academic Publishers, Boston, 2004

8.2 Laborator	Teaching methods	Remarks
1. Week: Preparation of hydroxyapatite (HAP) by precipitation	Explication; Practical work in goups	
2. Week: Preparation of HAP by sol-gel method; XRD, IR, DSC	Explication; Practical work in goups	
3. Week: Preparation of ZnO by precipitation	Explication; Practical work in goups	
4. Week: Preparation of ZnO by sol-gel method	Explication; Practical work in goups	
5. Week: Preparation of magnetite by precipitation	Explication; Practical work in goups	
6. Week: Preparation of nano-$CaCO_3$	Explication; Practical work in goups	
7. Week: Preparation of nano-MgO	Explication; Practical work in goups	
8. Week: Characterization of ZnO by XRD, IR, DSC	Explication; Practical work in goups	
9. Week: Particle size distribution measurements	Explication; Practical work in goups	
10. Week: SEM microscopy	Explication; Practical work in goups	

11. Week: AFM microscopy	Explication; Practical work in goups	
12. Week: TEM microscopy	Explication; Practical work in goups	
13. Preparation of a preferantial chosen nanomaterial (students choice)	Explication; Practical work in goups	
14. Week: Characterization of the synthesized material. Final examination	Explication; Practical work in goups. Individual final report	

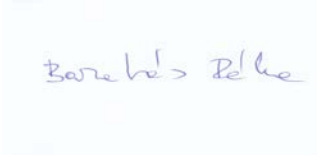
9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations, and representative employers within the field of the program

- Students acquire a solid knowledge base by the concepts and theoretical and methodological approach on mainly practical aspects and by using dedicated software in the field, according to partial competences required for occupations listed in Grid 1 - RNCIS.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Lecture	Evaluation of the way knowledge of the course has been acquired, the way of thinking	Written and computer-based practical examination.	60% (including the semestrial activity)
10.5 Laboratory	Individual activity on the seminar The quality and accuracy of solving the homework problems	The proceedings of the practical works should be presented at the laboratory meeting, according to the deadline	40%
10.6 Minimum performance standards			
• 5 is the minimum average • Capability to critically analyze own approach for solving problems; use computer and English language for continuous learning.			

Date Signature of course coordinator Signature of seminar coordinator



03.04. 2024

Date of approval Signature of the Director of the Department

04.04.2024