

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	Conf. dr. ing. BARABÁS Réka						
2.3 Seminar coordinator	Conf. 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	<ul style="list-style-type: none"> not necessary
4.2 competencies	<ul style="list-style-type: none"> not necessary

5. Prerequisites (if necessary)

5.1. for the course	<ul style="list-style-type: none">• Lecture room with video projector and internet
5.2. for the seminar /lab activities	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Basic knowledges regarding colloid systems and application of nanotechnologies• Understanding the basic laws of thermodynamics
Transversal competencies	<ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• Preparation of nanomaterials• Characterization of nanomaterials• Fundamentals of nanotechnologies
7.2 Specific objective of the discipline	2 basic preparation methods of nanomaterials <ul style="list-style-type: none">- “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 metallic 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-solid) 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. Discussions.	Lecture. Explanation. Conversation. Description. Discussion	

Bibliography:

1. G. B. Sergeev: Nanochemistry, Elsevier science & technology, 2006
2. W. R. Fahrner: Nanotechnology and Nanoelectronics, Springer-Verlag Berlin Heidelberg, 2005
3. C. Bréchnac, 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 groups	
2. Week: Preparation of HAP by sol-gel method; XRD, IR, DSC	Explication; Practical work in groups	
3. Week: Preparation of ZnO by precipitation	Explication; Practical work in groups	
4. Week: Preparation of ZnO by sol-gel method	Explication; Practical work in groups	
5. Week: Preparation of magnetite by precipitation	Explication; Practical work in groups	
6. Week: Preparation of nano-CaCO₃	Explication; Practical work in groups	
7. Week: Preparation of nano-MgO	Explication; Practical work in groups	
8. Week: Characterization of ZnO by XRD, IR, DSC	Explication; Practical work in groups	
9. Week: Particle size distribution measurements	Explication; Practical work in groups	
10. Week: SEM microscopy	Explication; Practical work in groups	

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

<ul style="list-style-type: none"> 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			
<ul style="list-style-type: none"> 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

Barbara Pelke

Barbara Pelke

03.04. 2023

Date of approval

Signature of the Director of the Department

04.04.2023

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