COURSE DESCRIPTION

BIONANOTECHNOLOGIES (in English)

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	Babeş-Bolyai University
1.2. Faculty	Biology and Geology
1.3. Department	Molecular Biology and Biotechnology
1.4. Field	Biology
1.5. Level of study	2 years, Full Time
1.6. Degree programme / Qualification	Molecular Biotechnology/Master
1.7. Form of education	Full Time

2. Course-related data

2.1. Course title	**BIONANOTECHNOLOGIES (in English)**			Course code	**BME1201**
2.2. Course coordinator	Professor dr. Manuela Banciu				
2.3. Seminar coordinator	Professor dr. Manuela Banciu				
2.4. Year of study	1	2.5. Semester	2	2.6. Type of assessment	Exam
2.7. Course status	Compulsory			2.8. Course type	Complementary subject

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	**4**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**2**
3.4. Total of hours in the curriculum	126	of which: 3.5. course	28	3.6. seminar/ laboratory	**28**

Time allocation for individual study (IS) and self-taught activities (ST)	**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)	30
Additional research in the library, on subject-specific electronic platforms, and on-site	20
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays	12
Tutoring (professional guidance)	2
Examinations	4
Other activities	2
3.7. Total hours of individual study (IS) and self-taught activities (ST)	**70**
3.8. Total hours per semester	**126**
3.9. Number of credits	**5**

4. Prerequisites (where applicable)

4.1. curriculum-related	-
4.2 skills-related	Interpretation of scientific information

5. Specific conditions (where applicable)

5.1. course-related	MS teams platform Audio-video logistics
5.2. seminar/laboratory-related	Admission at final evaluation is conditioned by at least 80% attendances at the scheduled laboratory classes.

6.1. Competencies resulting from the completion of the degree programme ***(as referred to in the curriculum)***

Professional competencies	
Competency code	**Competency**
PC1	Apply safety procedures in laborator, conduct research across discipline, apply scientific method, manage research data, draft scientific or academic papers and technical documentation.
PC2	Develop scientific theories, assist scientific research, manage research data,apply research ethics and scientific integrity principles in research activities.
Transversal competencies	
Competency code	**Competency**
TC1	Promote the transfer of knowledge, conduct research across disciplines, manage findable accessible interoperable and reusable data.

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
PC1 (belonging to DS)	1. The student explains and correlates the fundamental concepts of sequence analysis, alignment, genomic annotation, and structural modeling, highlighting the relationships between algorithmic methods and biological applications.	1. The student explains the physicochemical principles underlying nanoscale interactions in biological systems **PC2 belonging to DC)**
PC2 (belonging to DS)	2. The student explains the relationships between microbial genomic structure and environmental adaptation.	

7. Subject-specific learning outcomes

Knowledge and comprehension
1. The student understands the fundamental concepts of nanotechnology and bionanotechnology, including their interdisciplinary nature.
2. The student gained knowledge of major types of biomaterials, bionanosystems, and bionanosensors and their applications in nanomedicine, industry, and environmental monitoring.
3. The student understands the role of bionanotechnologies in addressing current challenges in biology, medicine, and environmental science.
Specific academic skills
1. The student is able to analyze, synthesize, and interpret advanced scientific information in bionanotechnology.
2. The student gained skills in preparing and presenting scientific papers/projects in English.
3. The student gained competence in identifying practical applications of theoretical concepts in biomedical and environmental contexts.
4. The student is able to work both independently and collaboratively in research and seminar activities.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks**
1. Introduction to Nanotechnology and, respectively, Bionanotechnology. Brief history, interdisciplinarity, Nanomedicine.	Discovery-based learning combined with traditional lecture-based teaching	2 hours
2. Applications of Bionanotechnologies: biomaterials, bionanosystems, bionanosensors, *etc*.	Discovery-based learning combined with traditional lecture-based teaching	2 hours

3-4. Biomaterials: applications in Nanomedicine, Environmental Quality Monitoring, food industry, agriculture, *etc*.	Discovery-based learning combined with traditional lecture-based teaching	4 hours
5-6. Bionanosystems: applications in targeted therapy and imaging	Discovery-based learning combined with traditional lecture-based teaching	4 hours
7. Modern techniques for obtaining and optimizing bionanosystems for biomedical applications.	Discovery-based learning combined with traditional lecture-based teaching	2 hours
8. Artificial viruses: methods of obtaining, advantages and disadvantages	Discovery-based learning combined with traditional lecture-based teaching	2 hours
9-10. Bionanosensors: structure, biological recognition processes, types.	Discovery-based learning combined with traditional lecture-based teaching	3 hours
10-11. Bionanosensors for biomedical applications	Discovery-based learning combined with traditional lecture-based teaching	3 hours
12. Bionanosensors used to monitor air and water quality	Discovery-based learning combined with traditional lecture-based teaching	2 hours
13. Molecular bionanosensors. Biomaterials used in tissue engineering	Discovery-based learning combined with traditional lecture-based teaching	2 hours
14. Biomaterials used in tissue engineering. Biomaterials used to produce biodegradable plastics	Discovery-based learning combined with traditional lecture-based teaching	2 hours
Bibliography Scientific articles from public databases (PubMed Central, SpringerLink ,etc.) accessed via „LUCIAN BLAGA" Central University Library of Cluj-Napoca, Anelis		
8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
Seminars – problem-based learning: design of bionanosystems with applications in targeted therapies	Seminars – problem-based learning	14 hours
Seminar – preparation,of a research project on a bionanotechnology topic in groups of 3–4 students	Discovery-based learning through the complex analysis of a topic from multiple perspectives	14 hours
Bibliography Scientific articles from public databases (PubMed Central, SpringerLink ,etc.) accessed via „LUCIAN BLAGA" Central University Library of Cluj-Napoca, Anelis		

9. Evaluation

Type of activity	9.1 Evaluation criteria	9.2 Evaluation methods	9.3 Percentage in the final grade
9.4. Course	Assessment of knowledge	Exam-presentation of a project in the field of Bionanotechnologies	50%
	The manner of presenting and synthesizing scientific information		
9.5. Seminar/ laboratory	Involvement in the problem-based learning seminars	Evaluation during the seminars	50%
9.6 Minimum standard for passing			
Knowledge of 50% of the information content of the course Involvement in at least 50% of the seminars activities.			

10. SDG labels (Sustainable Development Goals)

	x	Sustainable Development Generic Label

								
		x	x					
								No label applies

Date of entry:
9.04 2026

Signature of course coordinator

Prof. dr. Manuela Banciu

Signature of seminar coordinator

Prof. dr. Manuela Banciu

Date of approval in the department:
22.04.2026

Signature of the head of department

Associate Prof. Beatrice Kelemen