SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University of Cluj-Napoca**
1.2 Faculty	**Environmental Science and Engineering**
1.3 Department	**Environmental Analysis and Assessment**
1.4 Field of study	**Environmental Engineering**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Environmental Engineering**

2. Information regarding the discipline

2.1 Name of the discipline		**Physics II**					
2.2 Course coordinator		Associate prof. Begy Robert					
2.3 Seminar coordinator		Associate prof. Begy Robert					
2.4. Year of study	**I**	2.5 Semester	**II**	2.6. Type of evaluation	**E**	2.7 Type of discipline	Mandatory

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					32
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					14
Tutorship					2
Evaluations					2
Other activities:					

3.7 Total individual study hours	70
3.8 Total hours per semester	126
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	N/A
4.2. competencies	N/A

5. Conditions (if necessary)

5.1. for the course	Blackboard/Whiteboard, Videoprojector
5.2. for the seminar /lab activities	Laboratory

6. Specific competencies acquired

Professional competencies	• Acquiring a deep understanding of physical concepts (mechanical, electromagnetic, optical) applied to natural processes (e.g., gravitational field, Earth's magnetic field, pollutant transport) as well as in the development of environmental technologies (e.g., noise pollution reduction, implementation of renewable versus conventional energy sources). • Developing the ability to propose sustainable solutions for environmental issues based on the application of fundamental physical principles and critical analysis. • Developing skills in using measurement equipment and instruments, as well as analyzing and interpreting experimental data, in order to conduct rigorous and innovative research in the field of environmental protection.
Transversal competencies	• Acquiring an environmentally responsible component. • Development of a critical rationale, based on the performance and interpretation of quantitative analyses. • The ability to understand the laws that govern the Universe • The application of acquired knowledge in subjects such as Soil Science, Environmental Chemistry, Environmental Radioactivity, etc.

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

7.1 General objective of the discipline	The general objective of this course is to provide a solid understanding of the fundamental principles of physics and their application in the environmental field, thereby preparing students to address environmental issues with a sound scientific and technological foundation. The course aims to develop essential theoretical and practical skills, including the analysis of natural phenomena, the use of measurement equipment, and the interpretation of experimental data. Additionally, students will be encouraged to apply physical concepts to assess and solve current environmental challenges such as pollution, climate change, and the use of energy sources. The general objective is to create an interdisciplinary framework where students can integrate knowledge from physics, chemistry, and biology to propose innovative and sustainable solutions.
7.2 Specific objective of the discipline	The specific objective of this course is to provide students with a deep understanding of the fundamental principles of physics applied to the field of environmental studies. The course aims to develop essential skills for analyzing natural and technological processes through the lens of mechanical, electromagnetic, and optical concepts. Students will learn how to apply these principles to solve environmental problems such as pollution or the use of renewable energy sources. Additionally, the course emphasizes the development of critical thinking and the ability to propose sustainable solutions. Another objective is to familiarize students with the use of measurement equipment and instruments, which are essential for conducting experimental research. The course will enable students to understand the physical laws governing natural phenomena and apply this knowledge in interdisciplinary fields such as environmental chemistry or radioactivity.

8. Content

8.1 Course	Teaching methods	Remarks
1. Concepts of Fluid Statics. Pressure. Archimedes' Law	Interactive exposure Explanation Conversation	Structured as 2 hours classes

	Didactical demonstration	
2. Fluid Dynamics. Continuity Equation. Bernoulli's law. Applications	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
3. Concepts of Thermodynamics: Temperature and Heat.	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
4. Thermodynamic Principles. Internal Combustion Engines.	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
5. Mechanical and Electromagnetic Waves. The Doppler Effect	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
6. Lenses, Mirrors, and Optical Instruments.	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
7. Light Absorption. Beer-Lambert Law	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
8. Wave-Particle Duality. The External Photoelectric Effect.	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
9. Concepts of Atomic Physics.	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
10. The Bohr Model	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
11. The Atomic Nucleus and Radioactivity Phenomena	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
12. Nuclear Energy. Nuclear Reactor	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
13. Modern notions in physics.	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
14. Recap of Theoretical Concepts	Interactive exposure Explanation Conversation Didactical demonstration	Structured as 2 hours classes
Bibliography: Brinkman A., (2008), Physics of the Environment, Imperial College Press, 228 pg.		

Gabor A. Fizică II – suport de curs (https://enviro.ubbcluj.ro/wp-content/uploads/2022/04/FIZICA-SUPORT-CURS_IM-I.pdf)

Faraoni V., (2006), Exercises in Environmental Physics, Springer, 342 pg.

Ngo C., (2002), L'energie. Ressources, technologies et environnement, Paris, Dunod, 174 pg.

Presură C., (2014), Fizica povestită. Ed. Humanitas, Bucureşti, 644 pg.

Rodrigues A., Sardinha R., Pita G., (2021), Fundamental principles of Environmental Physics, Ed. Springer, Kindle Edition.

1. Simth C., (2001), Environmental physics, New York, Routledge, 304 pg.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Dimensionality	Experiment Explanation Conversation	Structured as 2 hours classes
2. Determination of Atmosheric Pressure	Experiment Explanation Conversation	Structured as 2 hours classes
3. Applications of Archimedes' Law	Experiment Explanation Conversation	Structured as 2 hours classes
4. Determination of the Specific Heat Capacity of Water	Experiment Explanation Conversation	Structured as 2 hours classes
5. Phase Transformations	Experiment Explanation Conversation	Structured as 2 hours classes
6. Calibration of a Thermometer	Experiment Explanation Conversation	Structured as 2 hours classes
7. Study of the Gas Law	Experiment Explanation Conversation	Structured as 2 hours classes
8. Construction of a Microscope	Experiment Explanation Conversation	Structured as 2 hours classes
9. Building a Prism Monochromator	Experiment Explanation Conversation	Structured as 2 hours classes
10. Obtaining the Atomic Spectrum of Hg and He	Experiment Explanation Conversation	Structured as 2 hours classes
11. Analyzing the Spectrum Emitted by Hydrogen Atoms. Determing the Rydberg Constant	Experiment Explanation Conversation	Structured as 2 hours classes
12. Determination of the wavelength of microwaves	Experiment Explanation Conversation	Structured as 2 hours classes
13. Milikan's experiment: Determining the elementary electric charge	Experiment Explanation Conversation	Structured as 2 hours classes
14. Colloquium	Experiment Explanation Conversation	Structured as 2 hours classes

Bibliography:

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Anton M., (2010), Fizică experimentală, Cluj-Napoca, Presa Universitară Clujană, 209 pg.

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

The content is consistent with the curriculum of similar national and international centers. The structure was created after studying the content of the program at the Faculty of Physics (Babeș-Bolyai University) or at the Institute of Environmental Physics (University of Bremen, http://www.pep.uni-bremen.de/service/lecturematerials/ index.html).

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of the theoretical concepts presented in the course	Written exam	80
10.5 Seminar/lab activities	Assignments	Evaluation of the practical work	20
10.6 Minimum performance standards			
Each student has to prove that (s)he acquired an acceptable level of knowledge and understanding. Attendance to laboratory activities is mandatory. A minimum grade of 5 is required to pass the exam.			

Date | Signature of course coordinator | Signature of seminar coordinator

Asoc. Prof. Begy Robert | Asoc. Prof. Begy Robert

4.12.2024

Date of approval | Signature of the head of department

Prof. Dr. Rosu Cristina