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TRADITIO ET EXCELLENTIA

FACULTATEA DE ŞTIINŢA ŞI INGINERIA MEDIULUI

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International Summer school in Envrironmental Science and Enginerring

Practical part at 7-12 Belis, Cluj County, Romania

Virtual part at June 23-27 in Skyp platform

This document serves as a description of a summer Shool/practice, which is expected to be financed by a BIP project. It will be carried out with the participation of students from the National University of Public Service (NKE) in Hungary and Aristotle University of Thessaloniki. The teaching staff, the organizing university, and NKE will provide professional training.

General Introduction

The summer school is intended for students specializing in Environmental Science, Environmental Engineering, or Environmental Physics. The primary focus of the program is the application of physical methods in the fields of environmental science and environmental engineering. Special emphasis is placed on the use of radioisotopes and the practical aspects of their radiological monitoring, both in present-day and historical contexts.

1. Among the various radiometric dating methods, **Pb-210 dating** is of particular importance in the program. Its significance lies in its ability to reconstruct environmental changes over the past 200 years—an interval that aligns with the period of industrialization, which brought about numerous environmental challenges. Students will have the opportunity to become familiar with the entire process, from sampling to age modeling. This is supported by the **limnological** component of the summer school.
2. **Erosion studies using radioisotopes** (e.g., Cs-137 or Pb-210) play a key role in assessing the environmental impacts of different land management practices. This topic is closely integrated with the **geodesy** component of the program.
3. The presence of **Naturally Occurring Radioactive Materials (NORM)** in the environment can significantly contribute to ambient dose rates. Measuring total gamma activity in soils using scanning techniques is of great relevance, both from environmental radiological and national security perspectives. Among NORM isotopes, **radium and radon** are of particular concern. The summer school includes hands-on training in these measurement techniques as well.
4. The data from the deployed meteorological station, as well as the data from cosmic radiation measurements, form part of the **environmental physics** aspect of the practice in addition to nuclear measurement techniques.

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The thematic areas and their added value are as follows:

The Enivironmental Physics (EP), Environmental Radioactivity (ER), Limnology and Paleolimnology (LI/PL) and Geodesy (GD) Modules

General objective

- **ER**: Acquiring knowledge related to the main aspects of the presence of ambient radioactivity and the potential applications of the existence of the radioactive decay phenomenon in the study of the environment monitoring and nuclear dating. Acquiring the basics in terms of radioactive pollution and associated risk assessment.
- **EP**: Acquisition of basic concepts in environmental physics
- **LI/PL**: To provide foundational knowledge in limnology and paleolimnology. Emphasis is placed on understanding water quality assessment and its role in environmental monitoring.
- **GD**: To introduce the fundamental principles of terrestrial positioning. The module covers instruments, tools, and methodologies for measuring angles, distances, and elevations, alongside basic geodetic computations.

Specific Objectives

- **ER:** Knowledge of the main components of the natural and artificial radioactivity of the environment. Acquiring knowledge related to the applications of nuclear radiation and the phenomenon of radioactive disintegration Acquisition of basic notions related to pollution with radioactive elements and dosimetry with major importance and relevance in the assessment of risks on the quality of the environment and population health Learning some basic methods and techniques for radioactivity detection and measurement.
- **EP**: Application of physics knowledge to understand environmental phenomena and the physical principles underlying environmental technologies. Acquisition of laboratory skills, including measurements, data processing, and interpretation of experimental data. Development of an appropriate scientific language.
- **LI/PL**: To introduce the core concepts of paleolimnology, including sampling strategies, sediment dating techniques, and the use of biological proxies (e.g., pollen, diatoms, cladocerans, chironomids, and chaoborids). The module also includes an introduction to multivariate methods for biostratigraphic data analysis, and the reconstruction of environmental conditions related to climate change and anthropogenic impacts.

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- **GD**: To apply fundamental geodetic concepts in the assessment and characterization of the physical environment of aquatic ecosystems. The focus is on conducting field measurements, processing geospatial data, and interpreting results within an environmental engineering context. Emphasis is also placed on developing proficiency in scientific communication.

Knowledge Outcomes

- **ER**: The student understands: the fundamental principles of radioactivity; methods and techniques for measuring radioactivity; the interpretation and analysis of experimental data; the ability to communicate specific concepts using appropriate scientific language; basic notions of nuclear energy; and the capacity for responsible analysis and evaluation of information.
- **EP**: The student knows: the fundamental principles of physics applied to environmental studies; methods and techniques for measuring physical quantities relevant to environmental monitoring; interpretation and analysis of experimental data; communication of specific concepts using appropriate scientific language.
- **LI/PL**: Students will gain a solid understanding of hydrobiological processes and the influence of human activities on aquatic systems. They will become familiar with the primary subjects of paleolimnological research, including stratigraphy, dating methodologies, and analytical techniques. They will also understand the societal relevance of paleolimnological studies in the context of global and local environmental change, as well as prehistoric environmental reconstruction.
- **GD**: Students will acquire knowledge of the mathematical, physical, and environmental science principles underpinning geodetic and environmental engineering practices. They will understand standard procedures for measuring angles, distances, and elevations, and will be competent in performing basic geodetic calculations required for environmental applications.

Skills Development

- **ER**: The student can correctly use the scientific language specific to radioactivity; apply radiation protection regulations in practical situations; interpret experimental data; use knowledge of radioactivity in interdisciplinary applications; apply critical reasoning; communicate and present research results; and collaborate in teams.
- **EP**: The student can correctly use the scientific language specific to environmental physics; apply the laws and principles of physics to explain natural phenomena and environmental processes; conduct experimental measurements and interpret the obtained results; collaborate effectively in teams.
- **LI/PL**: Students will be capable of analyzing the structure and function of aquatic ecosystems, recognizing the requirements of water quality in relation to human use, and appreciating the

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environmental significance of effective water resource management. They will also be able to apply paleolimnological techniques in practical contexts, such as habitat reconstruction and environmental assessment.

- **GD**: Students will develop the endurance and precision required for repetitive fieldwork. They will be able to perform basic leveling and angular measurements, as well as process and analyze geospatial data from field observations.

Responsibility and Autonomy

- **ER:** The student has the ability to assess the risks associated with radiation and apply radiation protection regulations; analyze and synthesize complex information; and identify relevant sources of information from specialized literature.
- **EP:** The student has the ability to work independently in conducting experiments and measurements; collect analyze and interpret experimental data; apply methods and techniques for monitoring environmental physical parameters; document and update knowledge through individual study; develop critical and analytical approaches in interpreting physical phenomena.
- **LI/PL**: Students will demonstrate environmentally responsible behavior and decision-making, particularly concerning the protection and management of aquatic ecosystems.
- **GD**: Students will be capable of working independently in conducting field experiments and measurements. They will be able to collect, evaluate, and interpret experimental data; apply geodetic methods in practical engineering tasks; and continuously improve their knowledge through independent study. They will also develop a critical and analytical mindset for interpreting environmental processes.

Practical Implementation and Program:

The number of students is expected to be between 20 and 30, which means groups of 5 to 8 students. Over the course of four working days, each group will complete the following practical exercises in a rotating system:

(1) Lake sampling,
(2) Geodesy,
(3) Radioecology and age determination,
(4) Environmental physics.

The detailed program is as follows:

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	Monady	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
8-9	*Arrival*	*Breakfast*	*Breakfast*	*Breakfast*	*Breakfast*	*Breakfast*
9-10	Registration	**(1)** Lake sampling Gr1 **(2)** Geodesy, **Gr2** **(3)** Radioecology and age determination.Gr3 **(4)** Environmental physics G4	**(1)** Lake sampling Gr2 **(2)** Geodesy, Gr3 **(3)** Radioecology and age determination.Gr4 **(4)** Environmental physics Gr1	**(1)** Lake sampling Gr3 **(2)** Geodesy, Gr4 **(3)** Radioecology and age determination.Gr1 **(4)** Environmental physics Gr2	**(1)** Lake sampling Gr4 **(2)** Geodesy, Gr1 **(3)** Radioecology and age determination.Gr2 **(4)** Environmental physics Gr3	**Closing Ceremoni**
10-11	Briefing					
11-12	Opening					
12-14	*Lunch*	*Lunch*	*Lunch*	*Lunch*	*Lunch*	*The program may change depending on the number of students and their arrival options/ possibilities
14-16	Reconnaissance (**Site visit**)	**(1)** Lake sampling Gr1 **(2)** Geodesy, Gr2 **(3)** Radioecology and age determination.Gr3 **(4)** Environmental physics Gr4 **Gr=Group**	**(1)** Lake sampling Gr2 **(2)** Geodesy, Gr3 **(3)** Radioecology and age determination.Gr4 **(4)** Environmental physics Gr1	**(1)** Lake sampling Gr3 **(2)** Geodesy, Gr4 **(3)** Radioecology and age determination.Gr1 **(4)** Environmental physics Gr2	**Cluj-Napoca, Turda canion and Salt mine, Site visit**	
16-18	**Geodesy, Paleolimnology, Radioactivity, and Environmental Physics Lectures** (*J. Korponai, R. Begy, Á. Farkas, E. Kutasi, D. Koch*)					
18-19						
19-20	*Dinner*	*Dinner*	*Dinner*	*Dinner*	*Dinner*	

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Student Grading:

Each student must have a notebook. Every student prepares a report from the completed exercise, which will be graded by the instructors at the end. The grading will focus on the student's ability to work in a team as well as their attitude toward the work. The number of ECTS credits available for the exercise is 4.

The Online Component of the Exercise:

In preparation for the exercise, an online component will be held prior to the practical work. This component will provide all the necessary information for the exercise that the students will need. During the online component, students will participate in a course every day of the week. They will take notes on the information presented. Then, they will engage in documentation and data collection, which will be sent electronically to the instructors. The sequence of the course series is as follows:

1. R. Begy – Radioisotopes in the Environment
2. J. Korponai – Fundamentals of Paleolimnology
3. E. Kutasi – Fundamentals of Geodesy
4. R. Begy – Application of 210Pb Dating to Lake Sediments
5. A. Farkas – Fundamentals of Environmental Physics.

Organizer and responsible person, **Dean,**

Assoc. Prof.dr. Begy Robert Csaba Assoc.Prof. dr. Ajtai Nicolaie

Cluj-Napoca,Romania

08.04.2025