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		Environmental Applied GIS					
2.2 Course coordinator		Lecturer PhD. Cristian Valeriu Maloș					
2.3 Seminar coordinator		Lecturer PhD. Cristian Valeriu Maloș					
2.4. Year of study	**II**	2.5 Semester	**IV**	2.6. Type of evaluation	**C**	2.7 Type of discipline	Ob.

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					14
Tutorship					6
Evaluations					2
Other activities: Field work					8

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	The knowledge acquired through the in-depth exploration of content delivered within the disciplines of Environmental Science Foundations, Informatics, Cartography, and Remote Sensing enhances both comprehension and accessibility of the proposed topics. Furthermore, participants will consolidate their operational conceptual framework by activating and leveraging their pre-existing informational repository.
4.2. competencies	The continued practical application of acquired knowledge enables a gradual progression through the chapters, closely aligned with the thematic content of previously studied disciplines.

5. Conditions (if necessary)

5.1. for the course	A room equipped with a video projector.
5.2. for the seminar /lab activities	A room equipped with computers, a video projector, a whiteboard, and software such as Quantum GIS, GRASS GIS and R.

6. Specific competencies acquired

Professional competencies	• Utilizing computer programs for representing environmental processes and phenomena on thematic maps; • Employing GPS tools in fieldwork; • Developing the skills necessary for drafting scientific papers in the field of environmental science; • Acquiring methods for field investigation of environmental factors.
Transversal competencies	• Developing skills to interpret and analyze environmental processes and phenomena in an integrated and holistic manner; • Building orientation skills in the field; • Gaining knowledge of working methods used in the environmental domain and the ways of representing the results of environmental studies; • Cultivating the abilities required for multidisciplinary collaboration, effective communication, and establishing partnerships grounded in the application of acquired knowledge and the development of transdisciplinary scientific reasoning.

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

7.1 General objective of the discipline	• Scientific and technical research and investigation with applications in the field of environmental science; • Developing the skills to identify significant aspects and integrate them into thematic maps;
7.2 Specific objective of the discipline	• Proficiency in using GIS software programs; • Understanding the differences between raster and vector data storage systems; • Capability to utilize the basic functions incorporated in GIS software; • Acquiring knowledge related to the creation of maps; • Familiarity with sources, types of documentation, and reference materials; • Mastering knowledge about various types of projections and coordinate systems; • Understanding the concept of spatial analysis and employing different geoprocessing tools; • Grasping the basic principles of GPS, remote sensing, and representing GPS-collected data on a map.

8. Content

8.1 Course	Teaching methods	Remarks
1. GIS – Introductory Concepts (Brief History, Definitions, Application Domains)	Lecture, Heuristic Conversation	2 hours
2. Fundamental GIS Concepts	Lecture, Heuristic Conversation	2 hours
3. Raster and Vector	Lecture, Brainstorming	2 hours

4. Coordinate Systems and Projections	Lecture, Heuristic Conversation	2 hours
5. Maps and Plans (Definitions, Classification, Map Elements). Characteristics of Digital Maps	Lecture, Brainstorming, Argumentation	2 hours
6. Geoprocessing Tools and Their Role	Lecture, Brainstorming	2 hours
7. Implementing Geographical Concepts in GIS	Lecture, Heuristic Conversation	2 hours
8. Spatial Analysis in GIS	Lecture, Brainstorming	2 hours
9. Potential Sources of Errors in GIS	Lecture, Heuristic Conversation, Brainstorming	2 hours
10. WebGIS	Lecture	2 hours
11. GIS Applications and Examples. GIS Software and Tools	Lecture	2 hours
12. GPS Systems	Lecture	2 hours
13. Remote Sensing Concepts and Specific Software	Brainstorming	2 hours
14. Geographic Information Technology in Society	Lecture, Argumentation	2 hours

Bibliography:

1. Boyles, David. GIS Means Business. Redlands, CA: ESRI Press, 2002.
2. Chrisman, Nick. Charting the Unknown: How Computer Mapping at Harvard Became GIS. Redlands, CA: ESRI Press, 2006.
3. Bonham-Carter, Graeme F. Geographic Information Systems for Geoscientists: Modelling with GIS. Kidlington: Pergamon, 1994.
4. Wright, Dawn J., Christian Harder, and Jared M. Diamond. GIS for Science: Applying Mapping and Spatial Analytics. ESRI Press, 2020.
5. Nelson, T. A., M. F. Goodchild, and D. J. Wright. Accelerating Ethics, Empathy, and Equity in Geographic Information Science. Proceedings of the National Academy of Sciences, 2022.
6. Rana, Sanjay. Frontiers of Geographic Information Technology. Berlin; Heidelberg; New York: Springer, 2006.
7. "Geospatial Information Research: State of the Art, Case Studies and Future Perspectives". Ralf Bill, Jörg Blankenbach, Martin Breunig, et al. Published 2022.
8. "Recent Developments in Geographic Information Systems Across Different Application Domains: A Review". Kuduva Janarthanan, Sowmiya Narayanan, Asaithambi Manimaran, 2023.
9. "Remote Sensing and GIS: Recent Trends and Applications". Chavan, Sirjan Murmu, Anamika Nepali, Pooja, 2023.

8.2 Seminar / laboratory	Teaching methods	Remarks
ntroduction to Software Packages (Quantum GIS, GRASS GIS)	Lecture	2 hours
Raster and Vector – Explanation and Examples	Exercise Method, Lecture	2 hours
Using Basic Geoprocessing Tools (clip, buffer, etc.)	Exercise Method, Lecture	2 hours
Georeferencing	Exercise Method, Lecture	2 hours
Digitizing and Obtaining Spatial Data	Exercise Method	2 hours
Adding Attributes to Objects	Exercise Method, Lecture	2 hours
Spatial Attributes and Their Analysis	Exercise Method	2 hours

Cartography Basics: Creating a Map Based on Previous Data	Exercise Method, Lecture	2 hours
Introduction to Spatial Analysis Based on DEM – Creating a DEM	Presentation, Brainstorming	2 hours
Simple Terrain Analyses (Slope, Aspect, Fragmentation Depth/Density)	Exercise Method, Lecture	2 hours
Complex Spatial Models and Analyses	Exercise Method, Lecture	2 hours
Individual Exercise on a Topic Assigned by the Instructor	Verification Method, Exercise	2 hours
Using GPS	Lecture	2 hours
Remote Sensing and Integration into a GIS Project. Knowledge Check	Verification Method	2 hours

Bibliography:

1. Campbell, James B., and Randolph H. Wynne. Introduction to Remote Sensing. Guilford Press, 2011.
2. Lawhead, Joel. Learning Geospatial Analysis with Python. Packt Publishing, 2019.
3. Green, Kass, Russell G. Congalton, and Mark Tukman. Imagery and GIS. Esri Press, 2017.
4. Liu, Jian Guo, and Philippa J. Mason. Image Processing and GIS for Remote Sensing. Wiley, 2016.
5. Bettinger, Pete, et al. Mapping Human and Natural Systems. Academic Press, 2019.
6. Menke, Kurt, et al. Mastering QGIS. Packt Publishing, 2016.
7. Steinberg, Sheila L., and Steven J. Steinberg. GIS Research Methods. Esri Press, 2015.

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 of the discipline aligns with the curricula studied in other university centers both nationally and internationally.
- An analysis of employer feedback regarding the preferred attributes of specialists has highlighted a high level of appreciation for their professionalism, confirming that the structure and content of the educational curriculum designed for this study program are accurate, comprehensive, and effective.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Acquisition of new knowledge	Colloquium	40%
	Ability to work with newly acquired knowledge		
10.5 Seminar/lab activities	Development of practical applications	Computer-based project	60%
	Decision-making capability		
10.6 Minimum performance standards			

- Understanding the application domains of GIS
- Knowledge of fundamental issues related to georeferencing and digitization
- Familiarity with methodological and practical aspects of spatial analysis
- Understanding basic cartographic elements for map creation

Date	Signature of course coordinator	Signature of seminar coordinator
5.12.2024		

Date of approval	Signature of the head of department