COURSE OUTLINE

1. Study programme information

1.1 Higher education institution	Universitatea de Vest din Timişoara
1.2 Faculty / Department	Chimie, Biologie, Geografie / Departamentul de Geografie
1.3 Sub-department	Geografie
1.4 Field of study	Geography
1.5 Level of study	Master's degree
1.6 Study programme / Qualification	Geographic Information Systems

2. Course information

2.1 Course title				**Programming**			
2.2 Course convenor/ Lecturer				Lect. Dr. Dornik Andrei			
2.3 Teaching assistant				Lect. Dr. Dornik Andrei			
2.4 Year of study	1	2.5 Semester	2	2.6 Type of assessment	E	2.7 Course type	DS/ DO

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

3.1 Number of hours per week	3	of which: 3.2 lecture	1	3.3 practical activity	2
3.4 Total hours in the curriculum	42	of which: 3.5 lecture	14	3.6 practical activity	28
Time distribution:					**hours**
Studying textbooks, course materials, bibliography and notes					25
Further research in libraries, on electronic platforms and in the field					25
Preparing seminars/ laboratories, homework, research papers, portfolios and essays					15
Tutoring					9
Examinations					9
Other activities ……					

3.7 Total hours of individual study	**83**
3.8 Total hours per semester	**125**
3.9 Number of credits	**5**

4. Prerequisites (if applicable)

4.1 based on curriculum	Introduction to programming; Basics in informatics; Geographic Information Systems; Geoinformatics
4.2 based on competencies	Basic skills of programming; analytical spirit and the ability to break down problems into sub-problems

5. Conditions (if applicable)

5.1 for the course	• Computer / laptop for the teacher and students • internet access; access to the Elearning UVT platform; • video projector
5.2 for the practical activity	• complete fulfilment of tasks of laboratory work and projects • Computer / laptop for the teacher and students; • internet access; access to the Elearning UVT platform; • video projector

6. Objectives of the discipline - expected learning outcomes to the formation of which contribute to the completion and promotion of the discipline

Knowledges	• Advanced knowledge on computer science and programming for GIS • Concepts related to the structure and operation of a program and web GIS applications • Concepts and methodologies regarding the development of GIS applications • Understanding operation of an advanced program
Skills	• Use Python programming language for GIS and remote sensing analysis: ▪ Data conversion: spreadsheets, GPS data, ASCII Grid files, Rasterizing a shapefile ▪ Working with projections ▪ Vector data analysis: measuring distance, ccessing and editing shapefiles, reading shapefile attributes and geometry, changing a shapefile, adding fields, merging and splitting shapefiles, subsetting spatially, performing selections, attribute selections, dot density calculations, geocoding, overlay analysis ▪ Raster Analysis: reading grids, writing grids, map algebra, histograms, feature extraction, extract by mask, multi-criteria analysis ▪ Network Analyst and Spatial Analyst: elevation data, creating a shaded relief, creating elevation contours, working with LIDAR data, creating a grid from LIDAR, creating a triangulated irregular network, interpolation methods ▪ Remote Sensing: band math, swapping image bands, performing a histogram stretch, clipping images, creating a Normalized Difference Vegetation Index, classifying images (supervised and unsupervised classification), change detection ▪ Visualizing analysis results: creating images for visualization, choropleth maps, Web apps
Responsibility and autonomy	• Development of a critical and analytical spirit among students; appreciating the advantages of using algorithmic thinking for GIS • The ability to solve specific GIS tasks autonomously • The ability to identify/select appropriate solutions and generate innovative ideas • The ability to correctly/effectively identify and plan tasks specific to a particular GIS project • The application of effective and responsible work strategies, based on the principles, norms and values of the code of professional ethics • Application of effective work techniques in a multidisciplinary team, ethical attitude, respect for diversity and multiculturalism, acceptance of diversity of opinion • Self-assessment of the need for continuous professional training for the purpose of insertion and adaptability to the requirements of the labor market • Capitalizing on the results obtained to analyses, studies and GIS projects

7. Content

7.1 Lecture	**Teaching methods**	**Observations**
1. Geospatial Python environment. ArcPy. Working with projections. Data conversion	Lecture, Interactive presentations, heuristic conversation, problematization and hands-on examples	2 hours
2. Vector data analysis		2 hours
3. Raster Analysis		2 hours
4. Network Analyst and Spatial Analyst		2 hours
5. Remote Sensing		2 hours
6. Visualizing GIS analysis results		2 hours
7. Evaluation, Feedback		2 hours

Bibliography

- Paul A. Zandbergen, 2020, Python Scripting for ArcGIS Pro, Esri Press, New York Street, Redlands, California
- Paul A. Zandbergen, 2020, Advanced Python Scripting for ArcGIS Pro, Esri Press, New York Street,

Redlands, California
- Joel Lawhead, 2015, Learning Geospatial Analysis with Python. An effective guide to geographic information system and remote sensing analysis using Python. Second Edition. Packt publishing, Birmingham
- Michael Diener, 2015, Python Geospatial Analysis Cookbook. 60 recipes to work with topology, overlays, indoor routing, and web application analysis with Python, Packt publishing, Birmingham
- Silas Toms, 2015, ArcPy and ArcGIS – Geospatial Analysis with Python, Packt publishing, Birmingham
- Erik Westra, 2013, Python Geospatial Development Second Edition. Learn to build sophisticated mapping applications from scratch using Python tools for geospatial development, Packt publishing, Birmingham
- Course and practical activity materials, presentations and references posted on Elearning UVT Platform (https://elearning.e-uvt.ro/)

7.2 Practical activity	**Teaching methods**	**Observations**
1. Geospatial Python environment. ArcPy. Data conversion with Python. Using spreadsheets. Using GPS data. ASCII Grid files. Working with projections. Reprojections. Rasterizing a shapefile	Hands-on exercises, case studies, scientific explanation and demonstration.	4 hours
2. Vector data analysis with Python. Measuring distance. Accessing and editing shapefiles. Reading shapefile attributes and geometry. Changing a shapefile. Adding fields. Merging and splitting shapefiles. Subsetting spatially. Performing selections. Attribute selections. Dot density calculations. Geocoding. Overlay		4 hours
3. Raster Analysis with Python. Reading grids. Writing grids. Map algebra. Histogram. Feature extraction. Extract by mask. Multi-criteria analysis		4 hours
4. Network Analyst and Spatial Analyst with Python. Elevation Data. Creating a shaded relief. Creating elevation contours. Working with LIDAR. Creating a grid from LIDAR. Creating a triangulated irregular network. Interpolation methods		4 hours
5. Python and Remote Sensing. Band math. Swapping image bands. Performing a histogram stretch. Clipping images. Creating a Normalized Difference Vegetation Index. Classifying images (supervised and unsupervised classification). Change detection		4 hours
6. Visualizing your analysis. Creating images for visualization. Choropleth maps. Web apps.		6 hours
7. Evaluation, Feedback		2 hours

Bibliography

- Paul A. Zandbergen, 2020, Python Scripting for ArcGIS Pro, Esri Press, New York Street, Redlands, California
- Paul A. Zandbergen, 2020, Advanced Python Scripting for ArcGIS Pro, Esri Press, New York Street, Redlands, California
- Joel Lawhead, 2015, Learning Geospatial Analysis with Python. An effective guide to geographic information system and remote sensing analysis using Python. Second Edition. Packt publishing, Birmingham
- Michael Diener, 2015, Python Geospatial Analysis Cookbook. 60 recipes to work with topology, overlays, indoor routing, and web application analysis with Python, Packt publishing, Birmingham
- Silas Toms, 2015, ArcPy and ArcGIS – Geospatial Analysis with Python, Packt publishing, Birmingham
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8. Corroborating course content with the expectations held by the representatives of the epistemic community, professional associations and typical employers in the field of the study programme

The content of the discipline was developed in accordance with the curriculum and meets the didactic and scientific requirements corresponding to similar specializations in other university centers. Programming facilitates the acquisition of knowledge in carrying out a research project, both from a theoretical point of view and from the point of view of working methods in the field, developing students' analytical thinking, the ability to problematize, to manage a scientific approach, of a database and its operation. The software used in the practical applications are among the most modern and frequently used in specialized institutions. Such applied training makes students compatible with the job market in the field of geographic information systems, or research activity.

9. Assessment

Type of activity	9.1 Assessment criteria	9.2 Assessment methods	9.3 Weight in the final mark
9.4 Lecture	Understanding and assimilation of knowledge	Oral evaluation	20%
9.5 Practical activity	Individual or group (2-3 students) project	Evaluation of: - program complexity - program functionality	80%
9.6 Minimum performance standard			
• Minimum mark 5 at course evaluation. • Minimum mark 5 at practical activities.			

Date

10.01.2024

Course convenor's signature

Lect. Dr. Andrei Dornik

Date of approval in the department

Head of department's signature