SYLLABUS

1. Information about the study programme

1.1 Institution of higher education	West University of Timisoara
1.2 Faculty	Chemistry, Biology, Geography
1.3 Department of	Geography
1.4 Field of study	Geography
1.5 Study cycle	Master's degree
1.6 Study programme	Geographic Information Systems

2. Information about the subject/discipline

2.1 Name			**Programming**				
2.2 Course coordinator			Conf. Univ. Dr. Dornik Andrei				
2.3 Seminar coordinator			Conf. Univ. Dr. Dornik Andrei				
2.4 Year of study	1	**2.5 Semester**	2	**2.6 Type of assessment**	E[1]	**2.7 Type of discipline**	DS/DOB

3. Total estimated time (hours of teaching per semester)[2]

3.1 Number of hours per week	**3**	**3.2 course**	**1**	**3.3 seminar/laboratory**	**2**
3.4 Total hours in the curriculum	**42**	**3.5 course**	**14**	**3.6 seminar/laboratory**	**28**
Distribution of time:					**hours**
Study based on Instructions, course materials, bibliography and notes					**25**
Additional documentation library, specialized electronic platforms / field					**25**
Training seminars / laboratories, homework, essays, portfolios and essays					**15**
Tutoring					**9**
Examinations[3]					**9**
Other activities					

3.7 Total hours of individual study	**74**
3.8 Total hours per semester[4]	**125**
3.9 Number of credits	**5**

[1] According to article 37, paragraph (1) of the Higher Education Law no. 199/2023, with subsequent amendments and additions, "the academic success of a student during a study program is determined by verifying the acquisition of the expected learning outcomes through exam-type evaluations and evaluation throughout the semester".
[2] The total number of contact hours and individual study hours will be aligned with the number of credits allocated to the course. One credit corresponds to a total between 25 and 30 hours of teaching activities and individual study. At the level of academic departments may establish, by discipline categories, the exact equivalence between one credit and the number of hours.
[3] The hours corresponding to examinations are added only to the point 3.8 – The total hours per semester, not to be added to the point 3.7 – Total hours of individual study.
[4] Total hours per semester = total hours in the curriculum + total hours of individual study + hours allocated to examinations.

4. Prerequisites (where applicable)

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

5. Conditions (where 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 laboratory	• complete fulfillment 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. Discipline objectives - expected learning outcomes which contribute to the completion and passing the discipline

Knowledge	• Advanced knowledge on computer science and programming for GIS • Concepts related to the structure and operation of a program and 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, 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 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 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. Contents

The platform through which the course materials in electronic format and other learning/bibliographic resources can be accessed: elearning.uvt.ro

7.1 Course	**Teaching methods**	**Comments**
1. Geospatial Python environment. Jupyter Notebook.	Lecture, Interactive presentations, heuristic conversation, problematization and hands-on examples	1 hours
2. Reading and writing geospatial data. Working with projections. Data conversion		2 hours
3. Vector data analysis		2 hours
4. Raster analysis		2 hours
5. Network Analyst and Spatial Analyst		2 hours
6. Remote Sensing		2 hours
7. Visualizing GIS analysis results		1 hours
8. 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. Laboratory	**Teaching methods**	**Comments**
1. Geospatial Python environment. Jupyter Notebook. 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		6 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.		4 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
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8. Corroboration of the course contents with the epistemic expectations of the community representative, professional associations and representative employers of the programme itself

The discipline's content was developed according to 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 practical applications' software is among the most modern and frequently used in specialized institutions. Such applied training makes students compatible with the job market in geographic information systems, or research activity.

9. Use of tools based on generative artificial intelligence

To complete the tasks defined in the assessment section, only for laboratory, the use of generative AII tools is permitted for generating ideas/slogans/designs/images/text rewriting, editing/reviewing. The most well-known examples of generative AII tools include, but are not limited to: ChatGPT, Google Gemini, Copilot for text, or MidJourney for images.
Each student will specify, in a statement written separately for each assignment, according to the model in Annex 3 of the Regulation on the use of generative artificial intelligence in the educational process at UVT, the tool they used, how it was used, and the part of the assignment in which it was used. The statement will be included by the student at the beginning of the submitted assignment.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of the final mark
10.4 Course	Understanding and assimilation of knowledge	Oral evaluation	20 %
10.5 Seminar	Individual project demonstrating the understanding and assimilation of practical skills (methods)	Complex Python script/tool/ software for geospatial analysis, developed during the semester, with the methods learned in laboratory activities. The project is uploaded to the e-learning platform. Oral and practical evaluation of: - program complexity - program functionality	80 %

10.6 Minimum performance standards

- Promotion of the course and laboratory with a minimum grade of 5 for each of these, according to the grading scales displayed during the examination.
- The assessment (practical and theoretical) is mandatory.
- No projects are permitted after the deadline has passed.
- Additionally, if deemed necessary, the teacher may supplement the examination with an oral assessment, as appropriate.
- According to the regulations, the same criteria also apply in the re-evaluation session.

Date of submission:
28.01.2026

Titular of the course: Conf. Dr. Andrei Dornik
Signature:

Date of approval in department:

Seminary titular: Conf. Dr. Andrei Dornik
Signature:

HEAD OF THE DEPARTMENT: Conf. dr. Ioan Sebastian Jucu