

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	Methods and models for analyzing remote sensing data						
2.2 Course coordinator	Lect. Dr. Florina ARDELEAN						
2.3 Seminar coordinator	Lect. Dr. Florina ARDELEAN						
2.4 Year of study	I	2.5 Semester	II	2.6 Type of assessment	E ¹	2.7 Type of discipline	DF/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					23
Tutoring					4
Examinations ³					6
Other activities					
3.7 Total hours of individual study	77				
3.8 Total hours per semester⁴	125				
3.9 Number of credits	5				

4. Prerequisites (where applicable)

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.

4.1 of curriculum	
4.2 of skills	basic knowledge in GIS

5. Conditions (where applicable)

5.1 for the course	<ul style="list-style-type: none"> • computer / laptop for the teacher and students • internet access; access to the e-learning.uvt.ro platform. • video projector
5.2 for the seminar	<ul style="list-style-type: none"> • computer / laptop for the teacher and students • internet access; access to the e-learning.uvt.ro platform. • video projector

6. Discipline objectives - expected learning outcomes which contribute to the completion and passing the discipline

Knowledge	<ul style="list-style-type: none"> • knowledge of the basics of electromagnetic spectrum and spectral signatures • knowledge on sensors, platforms and image acquisition methods • knowledge on the main types of satellite images and their acquisition and processing steps • develop multi-step remote sensing workflows to solve problems in the field of geosciences. • analyse digital remote sensing data independently using different image processing software. • extract relevant information from remotely sensed data using different manual and automated techniques. • integrating remote sensing data with other spatial data in geographical information systems • formulate a title and design a research project based on the use of remote sensing data in the field of geosciences (problem, hypothesis, objectives, methodology) and carry out independent projects with the use of remote sensing and GIS
Skills	<ul style="list-style-type: none"> • process remotely sensed data to make it useful for different applications in GIS environment • search, acquire and import relevant remote sensing images for the proposed project. • extract and process quantitative geo- and biophysical measurements from remotely sensed data • process optic satellite images using specific methods, such as feature extraction, thematic classifications and change detection analysis on different types of satellite images. • generate relevant geographical information by processing digital remotely sensed data and critically evaluate its use for environmental applications. • communicate project findings from the analysis of remotely sensed data through presentations

Responsibility and autonomy	<ul style="list-style-type: none"> • understanding of ethics in academic conduct (correct citations, avoiding plagiarism) • development of a critical and analytical spirit among students • developing team working abilities • developing communication skills to present relevant results in the field of geosciences
------------------------------------	--

7. Contents

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

7.1 Course	Teaching methods	Comments
1. Course introduction - structure, syllabus. Fundamentals of remote sensing, remote sensing principles. Electromagnetic radiation – physical properties and interactions.	Lecture, heuristic conversation, problematization and hands-on examples	2 hours
2. Remote sensing platforms and sensors. Passive and active remote sensing. Remote sensing products used in geoscience applications.		2 hours
3. Characteristics of satellite images and aerial photography. Multispectral remote sensing systems. Landsat, Sentinel, MODIS, Planet archives		2 hours
4. Remote sensing data acquisition, preprocessing, and analysis workflows.		2 hours
5. Classification of remotely sensed data. Change detection analysis. Accuracy assessment.		2 hours
6. Time series analysis. Space time analysis. Space-time cubes.		2 hours
7. Deep learning tools for remote sensing		2 hours

Bibliography:

- Campbell, J B., Wynne, R., 2011, Introduction to Remote Sensing, 5th edition. The Guilford Press. 667 p.
- Chuvieco, E., 2016, Fundamentals of satellite remote sensing: An environmental approach (2nd Edition) CRC Press, Boca Raton, Florida. 468 p.
- Gorelick, N., Hancher, M., Dixon, M., Ilyushchenko, S., Thau, D., Moore, R., 2017, Google Earth Engine: Planetary-scale geospatial analysis for everyone, Remote Sensing of Environment, 202, 18-27, doi.org/10.1016/j.rse.2017.06.031
- Green, K., Congalton, R., Tukman, M. 2017, Imagery and GIS: Best practices for extracting information from imagery. ESRI Press, Redlands, California. 437 p.
- Hussain, M., Chen, D., Cheng, A., Wei, H., Stanley, D., 2013. Change detection from remotely sensed images: From pixel-based to object-based approaches. ISPRS Journal of Photogrammetry and Remote Sensing, 80, 91-106.
- Jensen, J.R., 2007, Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Ed., Prentice Hall.

<ul style="list-style-type: none"> ➤ Lillesand, T., Kiefer, R., Chipman, J., 2015. Remote Sensing and Image Interpretation, 7th ed., Wiley, 720 p. ➤ Mather, Paul M., Koch, Magali, 2011, Computer processing of remotely sensed images-An introduction (4th Edition), Wiley-Blackwell, 462 p. ➤ Prost, G. L., 2013, Remote Sensing for Geoscientists: Image Analysis and Integration, Third Edition, CRC Press Taylor and Francis Group, 702 p. ➤ Richards, J.A., 2013, Remote sensing digital image analysis, Springer, 494 p. ➤ Strahler, A.H., Woodcock, C.E., Smith, J.A., 1986. On the nature of models in remote sensing. Remote Sensing of Environment, 20(2), 121-139. ➤ https://natural-resources.canada.ca/sites/nrcan/files/earthsciences/pdf/resource/tutor/fundam/pdf/fundamentals_e.pdf ➤ https://spatialanalysisonline.com/HTML/index.html ➤ Course-related materials, presentations, and references posted on the e-learning WUT platform (https://elearning.e-uvt.ro/) 		
7.2. Seminar	Teaching methods	Comments
1. Solutions and tools for satellite image acquisition and processing. Online data sources for remote sensing. Training data sources for remote sensing.	Hands-on exercises /Scientific explanation/ heuristic conversation	2 hours
2. Feature extraction, thematic classification, accuracy assessment		4 hours
3. Landcover/land use classification. Change detection analysis (i.e. urban growth)		4 hours
4. Time series analysis of remotely sensed data		4 hours
5. Deep learning tools for remote sensing applications		4 hours
6. Remote sensing of land indicators for sustainable development		4 hours
7. Final project – structure, spatial data acquisition, processing, and analysis		6 hours
Bibliography:		
<ul style="list-style-type: none"> ➤ Green, K., Congalton, R., Tukman, M. 2017, Imagery and GIS: Best practices for extracting information from imagery. ESRI Press, Redlands, California. 437 p. ➤ Jensen, J.R., 2007, Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Ed., Prentice Hall. ➤ Mather, Paul M., Koch, Magali, 2011, Computer processing of remotely sensed images-An introduction (4th Edition), Wiley-Blackwell, 462 p ➤ https://www.esri.com/training/ ➤ https://appliedsciences.nasa.gov/join-mission/training ➤ https://spatialanalysisonline.com/HTML/index.html ➤ https://gisgeography.com/remote-sensing-applications/ ➤ https://learn.arcgis.com/en/gallery/#?c=imagery ➤ https://earthexplorer.usgs.gov/ ➤ https://scihub.copernicus.eu/dhus/#/home 		

- <https://search.earthdata.nasa.gov/search>
- <https://www.youtube.com/watch?v=eJFHMestpCo>
- <https://resources.maxar.com/product-samples>
- <https://www.planet.com/products/>
- <https://glad.earthengine.app/view/global-forest-change#dl=1;old=off;bl=off;lon=166.36956895580315;lat=61.532855836607766;zoom=3;>
- <https://www.esa-landcover-cci.org/>
- <https://modis.gsfc.nasa.gov/data/dataproduct/mod12.php>
- <https://terra.ipums.org/>
- Practical activity materials, presentations and references posted on e-learning WUT platform (<https://elearning.e-uvt.ro/>)

8. Corroboration of the course contents with the epistemic expectations of the community representative, professional associations and representative employers of the programme itself

The content of the course was developed in accordance with the curriculum and meets the didactic and scientific requirements corresponding to similar specializations in other universities. Course content will offer the students the necessary skills to acquire, integrate, process and analyse different types of remote sensing data to start-up GIS projects in the field of geosciences. It stimulates the personal involvement of students in identifying problems that are suitable to be solved using remotely sensed data in a GIS environment. The software solutions used in this course (commercial and open source) are among the most modern and frequently used in specialized institutions in the field of remote sensing applications.

9. Use of tools based on generative artificial intelligence

To complete the tasks defined in the assessment section, the use of generative AI tools (ChatGPT, Google Gemini, Copilot) is permitted under certain conditions: the use of AI tools is permitted for generating editing/reviewing/reformulating texts, but not for generating figures such as maps, graphs and not for processing geospatial data. 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 – concepts and methods in remote sensing and their corresponding applications	Written exam	40 %
10.5 Seminar	Final project (content and results)	Evaluation of the results	60 %

		(written report on e-learning and oral presentation of the project)	
10.6 Minimum performance standards			
<ul style="list-style-type: none">• Minimum mark 5 at course evaluation.• Minimum mark 5 at practical activities.			

Date of submission:

02.02.2026

Titular of the course and seminar:

Lect. Dr. Florina ARDELEAN

Date of approval in department:

HEAD OF THE DEPARTMENT:

Assoc. prof. Sebastian JUCU