COURSE OUTLINE

1. Study programme information

1.1 Higher education institution	West University of Timisoara
1.2 Faculty / Department	Chemistry, Biology, Geography / Geography
1.3 Sub-department	
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				Methods and models for analysing remote sensing data			
2.2 Course convenor/ Lecturer				Dr. Loredana COPĂCEAN			
2.3 Teaching assistant				Dr. Loredana COPĂCEAN			
2.4 Year of study	I	2.5 Semester	II	2.6 Type of assessment	E	2.7 Course type	DS

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 seminar/laboratory	2
3.4 Total hours in the curriculum	42	of which: 3.5 lecture	14	3.6 seminar/laboratory	28
Time distribution:					**hours**
Studying textbooks, course materials, bibliography and notes					14
Further research in libraries, on electronic platforms and in the field					20
Preparing seminars/ laboratories, homework, research papers, portfolios and essays					20
Tutoring					15
Examinations					14
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	•
4.2 based on competencies	•

5. Conditions (if applicable)

5.1 for the course	• Compulsory presence at half of the meetings
5.2 for the seminar/laboratory	• Compulsory presence at half of the meetings

6. Accumulated specific competencies

Peofessional competencies	• 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 • analyze 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
Transversal competencies	• understanding of ethics in academic conduct (correct citations, avoiding plagiarism) • developing team working abilities • developing communication skills to present relevant results in the field of geosciences

7. Course objectives (as resulting from the accumulated specific competencies)

7.1 General objective	• process remotely sensed data to make it useful for different applications in GIS environment
7.2 Specific objectives	• 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) • search, acquire and import relevant remote sensing images for the proposed project • process satellite images using specific methods (geometric and radiometric calibration, atmospheric corrections etc) • generate 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

8. Content

8.1 Lecture	**Teaching methods**	**Observations**
Course introduction - structure, syllabus. Remote sensing principles	Lectures	
Electromagnetic radiation – physical properties and interactions	Lectures	
Remote sensing platforms and sensors	Lectures	
Aerial photography. Elements of visual interpretation. Photogrammetric measurements	Lectures	
Multispectral remote sensing systems. Landsat, Sentinel and MODIS archives	Lectures	
RADAR and LiDAR system characteristics	Lectures	
Satellite images acquisition, storage, preprocessing and analysis workflows. Accuracy assessment in remote sensing	Lectures	
Remote sensing applications in geosciences: land use-landcover changes, vegetation analysis, feature extraction change detection, and spatial modeling	Lectures	
Remote sensing applications in geosciences: natural hazards (floods, snow avalanches, drought)	Lectures	

Remote sensing applications in geosciences: urban growth	Lectures	

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., 2006, *Remote Sensing of the Environment: An Earth Resource Perspective*, 2nd Ed., Prentice Hall, 608 p.

Lillesand, T., Kiefer, R., Chipman, J., 2015. *Remote Sensing and Image Interpretation*, 7th ed., Wiley, 720 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.

http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/educational-resources/9309

https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutor/fundam/pdf/fundamentals_e.pdf

8.2 Seminar / laboratory	**Teaching methods**	**Observations**
Solutions and tools for satellite images acquisition and processing	Hands-on exercises	
Image resolution, information content, data format	Hands-on exercises	
Image preprocessing, image enhancement, filters	Hands-on exercises	
Normalized indices (i.e. from Landsat, Sentinel)	Hands-on exercises	
Feature extraction, thematic classification, accuracy assessment	Hands-on exercises	
Landcover/landuse classification	Hands-on exercises	
Change detection and spatial modeling (vegetation, urban growth)	Hands-on exercises	
Natural hazards applications – snow avalanches, floods, forest fires, drought analysis based on satellite images	Hands-on exercises	
Final project	Presentation	

References

https://arset.gsfc.nasa.gov/

https://rus-training.eu/

http://earthexplorer.usgs.gov/

https://scihub.copernicus.eu/dhus/#/home

https://neo.sci.gsfc.nasa.gov/

https://search.earthdata.nasa.gov/search

https://youtu.be/eJFHMestpCo

https://www.digitalglobe.com/samples

http://earthenginepartners.appspot.com/science-2013-global-forest

https://www.esa-landcover-cci.org/

https://modis.gsfc.nasa.gov/data/dataprod/mod12.php

https://terra.ipums.org/

9. 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

Course content will offer the students the necessary skills to acquire, integrate, process and analyze different types of remote sensing data in order to start-up GIS projects in the field of geosciences. The course will offer several software solutions (commercial and open-source) used by companies in the field of remote sensing applications

10. Assessment

Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final mark
10.4 Lecture	Knowledge and understanding of concepts in remote sensing and corresponding applications	Written exam	30%
10.5 Seminar / laboratory	Remote sensing project report – structure, objectives, methods, results, conclusions)	Written report (review)	20%
	Final project in remote sensing (content and results)	Presentation of results generated in the research project (oral evaluation)	50%
10.6 Minimum performance standard			
• grade 5 as a mean of evaluation percentage from the above mentioned compulsory activities			

Semnătura titularului de curs Semnătura titularului de seminar

Data completării

26.01.2022

Data avizării în catedră/departament

Semnătura şefului catedrei/departamentului