COURSE OUTLINE

1. Study programme information

Higher education institution	West University of Timisoara
1.2 Faculty	Chemistry, Biology, Geography
1.3 Department	Geography
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			GIS analysis of natural hazards and risk phenomena				
2.2 Course convenor/ Lecturer			Lect. Dr. Florina Ardelean				
2.3 Teaching assistant			Lect. Dr. Florina Ardelean				
2.4 Year of study	II	2.5 Semester	I	2.6 Type of assessment	Exam	2.7 Course type	DS/ DO

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

3.1 Number of hours per week	4	of which: 3.2 lecture	2	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:					**ore**
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					10
Examinations					8
Time distribution:					-

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	Geographic Information Systems, Fundamentals in Remote Sensing
4.2 based on competencies	Basic skills in GIS and remote sensing

5. Conditions (if applicable)

5.1 for the course	• Computer / laptop for the teacher and students • internet access; access to the E-learning UVT platform; video projector
5.2 for the seminar/laboratory	• Computer / laptop for the teacher and students • internet access; access to the E-learning UVT platform; video projector

6. Specific skills acquired

Knowledge	• Knowledge of concepts in spatial analysis and modeling in GIS environment • Knowledge of natural hazard mapping, vulnerability, and risk assessment methods • Knowledge of types of spatial data used in hazard mapping and risk assessment
Skills	• Knowledge and use of ArcGIS, QGIS, Google Earth Engine to analyze main types of natural hazards and to evaluate risk • Skills in using various types of spatial data, such as DEMs, satellite images, and aerial photos to evaluate and analyze natural hazards • Apply specific methods to analyze, evaluate and map flood risk, slope processes, climate change-associated risks

Responsibility and autonomy	• Development of a critical and analytical spirit among students; appreciating the advantages of using spatial analysis in the assessment of natural hazards and risk • 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 insertion and adaptability to the requirements of the labor market

7. Content

7.1. Course	**Teaching methods**	**Observaţii**
Natural processes and phenomena: concept, definition, hazard, vulnerability, risk. Hazard types; main concepts of hazard assessment;	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours
Sources of spatial data, and data requirements for various hazard types.	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours
Climate-related hazards – drought, urban heat island, temperature, precipitation extremes, climate change scenarios	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours
Hydrological hazards – flood mapping and monitoring, flood risk assessment.	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours
Geomorphological hazards – landslides, gully erosion,	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours
Land degradation and sustainable cities	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours
Risk evaluation and management. Multi-hazard risk assessment, an integrated approach.	Lecture, Interactive presentations, heuristic conversation, problematization	2 hours

References

- Birkmann, J., Kienberger, S., Alexander, D. 2014. Assessment of Vulnerability to Natural Hazards: A European Perspective, Elsevier, 240 pp.
- Carrara, A., Guzzetti, F. 2013. Geographical Information Systems in Assessing Natural Hazards, Springer Science & Business Media, 356 pp.
- Conforti, M., Aucelli, P.C., Robustelli, G., Scarciglia, F. 2011. Geomorphology and GIS analysis for mapping gully erosion susceptibility in the Turbolo stream catchment (Northern Calabria, Italy), *Nat Hazards*, 56:881-898. doi: 10.1007/s11069-010-9598-2
- Crespi, A., K. Renner, M. Zebisch, I. Schauser, N. Leps & A. Walter (2023) Analysing spatial patterns of climate change: Climate clusters, hotspots and analogues to support climate risk assessment and communication in Germany. Climate Services, 30, 100373.
- Diriba, D., Takele, T., Karuppannan, S., & Husein, M., 2024, Flood hazard analysis and risk assessment using remote sensing, GIS, and AHP techniques: a case study of the Gidabo Watershed, main Ethiopian Rift, Ethiopia. *Geomatics, Natural Hazards and Risk*, *15*(1). https://doi.org/10.1080/19475705.2024.2361813
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- Gares, A., P., Douglas, J.S., Nordstrom, F.K. 1994. Geomorphology and natural hazards, Geomorphology, 10.
- Ho, M-C., Shaw, D., Lin, S., Chiu, Y-C. 2008. How Do Disaster Characteristics Influence Risk Perception? Risk Analysis, Vol. 28, No. 3, 635-643. DOI: 10.1111/j.1539-6924.2008.01040.x
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- Mazzanti, P., Romeo, S. (ed.), 2023, Remote Sensing for Natural Hazards Assessment and Control, in Remote Sensing, 395 p., https://doi.org/10.3390/books978-3-0365-6833-1
- Napieralski, J., I. Barr, U. Kamp & M. Kervyn. 2013. 3.8 Remote Sensing and GIScience in Geomorphological Mapping. In Treatise on Geomorphology, ed. J. F. Shroder, 187-227. San Diego: Academic Press
- Navarro, D., Cantergiani, C., Abajo, B. et al., 2023, Territorial vulnerability to natural hazards in Europe: a composite indicator analysis and relation to economic impacts, *Nat Hazards*, https://doi.org/10.1007/s11069-023-06165-w
- Petropoulos, G., Islam, T., 2018, Remote Sensing of Hydrometeorological Hazards, 1st Edition, CRC Press, 549 p.
- Sarkar, Raju, Saha, Sunil, Adhikari, Basanta Raj, Shaw, Rajib, 2024, Geomorphic Risk Reduction Using Geospatial Methods and Tools, Springer, 325 p., https://doi.org/10.1007/978-981-99-7707-9
- Shastry, A., E. Carter, B. Coltin, R. Sleeter, S. McMichael & J. Eggleston, 2023, Mapping floods from remote sensing data and quantifying the effects of surface obstruction by clouds and vegetation. Remote Sensing of Environment, 291, 113556.
- Van Westen, C.J., 2013. Remote sensing and GIS for natural hazards assessment and disaster risk management. In: Shroder, J. (Editor in Chief), Bishop, M.P. (Ed.), Treatise on Geomorphology. Academic Press, San Diego
- https://www.esri.com/en-us/industries/earth-sciences/disciplines/climate-science?srsltid=AfmBOoozgYF4OEEdgO2o8Zh7gMRbcH2-stnvSA8PhsFFOBjYIfgXppAR

8.2. Seminar/laborator	**Metode de predare**	**Observaţii**
Data sources and portals for natural hazards and risk assessment.	Hands-on exercises, case studies, scientific explanation and demonstration.	2 hours
Climate-related hazards and risk assessment (i.e. drought monitoring, urban heat island, climate change scenarios).	Hands-on exercises, case studies, scientific explanation and demonstration.	6 hours
Hydrological hazards (flood mapping and monitoring, risk assessment).	Hands-on exercises, case studies, scientific explanation and demonstration.	6 hours
Geomorphic hazards (slope processes, landslides, and technological risk).	Hands-on exercises, case studies, scientific explanation and demonstration.	6 hours
Land degradation and sustainable cities.	Hands-on exercises, case studies, scientific explanation and demonstration.	6 hours
Selection of project topic related to hazard and risk assessment – structure, references, application (data sources, methods).	Hands-on exercises, case studies, scientific explanation and demonstration.	2 hours

References

- Gao, J., 2023, Remote sensing of natural hazards, CRC Press, 463 p.
- Van Westen, C.J., 2013. Remote sensing and GIS for natural hazards assessment and disaster risk management. In: Shroder, J. (Editor in Chief), Bishop, M.P. (Ed.), Treatise on Geomorphology. Academic Press, San Diego
- https://appliedsciences.nasa.gov/what-we-do/disasters/practitioner-resources#earthdatasearch
- https://maps.disasters.nasa.gov/arcgis/apps/sites/#/home/
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-climate-change-monitoring-and-impacts-assessment-using-nasa
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-remote-sensing-drought
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-drought-monitoring-prediction-and-projection-using-nasa-earth
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-satellite-remote-sensing-measuring-urban-heat-islands-and
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-nasa-remote-sensing-flood-monitoring-and-management
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-monitoring-and-modeling-floods-using-earth-observations
- https://storymaps.arcgis.com/stories/7203b560ad654339b58430e90b71cde8
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-remote-sensing-monitoring-land-degradation-and-sustainable
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-satellite-observations-analyzing-natural-hazards-small-island
- https://appliedsciences.nasa.gov/get-involved/training/english/arset-transforming-earth-observation-eo-data-building-infrastructure
- https://experience.arcgis.com/experience/0295557a52b5446595fc4ba6a97161bb/page/Page
- https://www.esri.com/en-us/industries/earth-sciences/disciplines/climate-science?srsltid=AfmBOoozgYF4OEEdgO2o8Zh7gMRbcH2-stnvSA8PhsFFOBjYIfgXppAR

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 program

The course can stimulate the personal involvement of students in the identification and spatial and temporal assessment of some processes and natural phenomena with potential risks.
The course facilitates the initiation of contacts and collaborations with specialized institutions in the field of natural hazards and risks.

10. Assessment

Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final mark
10.4 Course	Understanding and assimilation of knowledge – concepts and methods in spatial analysis and remote sensing applied in natural hazards	written exam	40%
10.5 Laboratory	Individual project (content and results)	Presentation of results (written report on e-learning and oral evaluation of the presented project)	60%
10.6 Minimum performance standard			
Minimum mark 5 at course evaluation. Minimum mark 5 at practical activities.			

Date
13.09.2024

Course convenor’s signature

Lect. Univ. dr. Florina Ardelean

Date of approval in the department

Head of department’s signature