Natural Hazards and Disaster Risk Reduction

Course description sheet

Basic information

Field of study Remote Sensing and Geo Informatics **Major** All **Organisational unit** Faculty of Geo-Data Science, Geodesy, and Environmental Engineering **Study level** Second-cycle studies **Form of study** Full-time studies **Profile** General academic	**Didactic cycle** 2026/2027 **Course code** DRSGIS.II4.15499.26 **Lecture languages** English **Mandatoriness** Obligatory **Block** Core Modules **Course related to scientific research** Yes

Course coordinator	Wojciech Drzewiecki
Lecturer	Wojciech Drzewiecki, Urszula Marmol, Beata Hejmanowska, Sławomir Mikrut, Ewa Głowienka, Natalia Borowiec, Tomasz Pirowski, Antoni Rzonca, Mariusz Twardowski

Period	**Method of verification of the learning outcomes**	**Number of ECTS credits**
Semester 3	Exam **Activities and hours** Lectures: 30 Workshop classes: 120	12

Goals

C1	knowledge and skills about monitoring, detection and management of disasters and natural hazards, based on emerging technologies and optimal techniques.

Course's learning outcomes

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
Knowledge – Student knows and understands:			
W1	knowledge about methods and algorithms for disaster managment	RSGI2A_W01, RSGI2A_W04, RSGI2A_W05	Execution of a project, Test, Examination, Report
Skills – Student can:			
U1	apply optimal technologies and techniques in monitoring of disasters and natural hazards	RSGI2A_U02, RSGI2A_U03, RSGI2A_U04	Execution of a project, Report
U2	perform advanced spatial analysis using remote sensing and lidar data	RSGI2A_U02, RSGI2A_U03, RSGI2A_U04	Execution of a project, Report
U3	recognize the requirements for ensuring an ongoing hazard and risk assessment process	RSGI2A_U02, RSGI2A_U03, RSGI2A_U04	Execution of a project, Report
Social competences – Student is ready to:			
K1	intentionally select fit-to-use data	RSGI2A_K01	Participation in a discussion, Execution of a project, Test, Report
K2	independently and creatively solve problems in the scope of disaster and natural hazards monitoring	RSGI2A_K02	Participation in a discussion, Execution of a project, Report

Program content ensuring the achievement of the learning outcomes prescribed to the module

Student obtain knowledge for critical analysis of the existing methods that are relevant to a disaster scenario. Student obtains knowledge and skills about monitoring, detection and management of disasters, based on emerging technologies and optimal techniques especially on remote sensing and geoinformation systems.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Lectures	30
Workshop classes	120
Preparation for classes	40
Examination or final test/colloquium	2
Preparation of project, presentation, essay, report	70
Realization of independently performed tasks	40
Contact hours	5

Student workload	Hours 307
Workload involving teacher	Hours 150

* hour means 45 minutes

Program content

No.	Program content	Course's learning outcomes	Activities
1.	During lectures, student will gain knowledge about monitoring, detection and management of disasters, based on emerging technologies and optimal techniques. Lectures present a critical analysis of the existing methods that are relevant to a disaster scenario, such as remote sensing technique, artificial intelligence, UAV and satellite imagery as well as possible utilisation of spatial models to prevent and manage natural hazard and disaster risk. The workshop part consists of performing an individual project from the available selection of topics. Examples of projects: Flood modelling based on lidar or radar data. Risk of earthquakes by revealing faults on the ground surface using lidar and remote sensing data. Detection and monitoring of land deformation related to landslides or mining activities based on laser data. Detection and monitoring of land deformation associated with landslides or mining activities based on differential radar interferometry. Application of GIS and machine learning technologies to identification of landslide prone areas. Identification of soils in danger of degradation due to soil erosion by water or wind. Application of remote sensing to fire detection and monitoring The work includes the design part, data collection, data processing, preparation of a report.	W1, U1, U2, U3, K1, K2	Lectures, Workshop classes

Extended information/Additional elements

Teaching methods and techniques :

Lectures, Discussion, E-learning, Case study, Design thinking, Problem Based Learning, Workshop

Activities	Methods of verification	Credit conditions
Lectures	Test, Examination	Lectures are optional. The condition for passing is to obtain a positive grade in the final test checking the knowledge of issues presented during lectures.
Workshop	Participation in a discussion, Execution of a project, Report	Workshops are mandatory. Credit is based on student's activity and presented project task reports.

Conditions and the manner of completing each form of classes, including the rules of making retakes, as well as the conditions for admission to the exam

Lectures are passed on the basis of the results of the final test. The basis for passing the classes is the performance of current practical exercises and the timely presentation of reports on the completed project tasks (or presentation of the completed project during classes). In the case of evaluating a project task, the correctness of the adopted methodology for solving the task, its final effect and the quality of results presentation will be assessed. The oral answer of the student may be an element of passing the project exercise. To pass the course, it is required to actively participate in project exercises (performing current tasks and exercises during classes) and to obtain positive grades (minimum 3.0) from the final test from the theorethical basis and from each of the completed projects. The final grade from the exercises will be the average of the grades obtained from individual projects. The basic deadline for obtaining a credit is the end of classes in a given semester. The student has the right for resit twice.

Method of determining the final grade

The final grade is a weighted average of the grade of the test checking the knowledge of theoretical basis (35%) and the project grade based on the quality of the submitted project report (65%).

Manner and mode of making up for the backlog caused by a student justified absence from classes

Compensating for the backlog caused by absence: depending on the classes subject – self-realisation of excercises with the help of individual consultations with the instructor.

Rules of participation in given classes, indicating whether student presence at the lecture is obligatory

Lecture: Attendance optional. Audiovisual recording of the lecture requires the consent of the lecturer. Project exercises: Attendance at exercises is obligatory. Students perform, in accordance with the guidelines and materials provided by the teacher, practical work aimed at obtaining the competences assumed by the syllabus. The student is obliged to prepare himself in the subject of the exercise, which can be verified in an oral or written test. The method of performing the exercises and the final effect, including the way of presenting the results, are assessed.

Literature

Obligatory

1. Zhenhong Li, Roberto Tomás, Earth Observations for Geohazards, ISBN 978-3-03842-397-3

Optional

1. Kundu, S.N. (2017). Geohazard Modeling Using Remote Sensing and GIS. In: Sengupta, D., Agrahari, S. (eds) Modelling Trends in Solid and Hazardous Waste Management. Springer

Scientific research and publications

Publications

1. Borowiec N., Marmol U., 2022. Using LiDAR system as a data source for agricultural land boundaries Remote Sensing, vol. 14 iss. 4 pp. 1–17.

2. Marmol U., 2017. Wavelet analysis of airborne laser scanning data in the process of automatic extraction of selected objects. Rozprawy Monografie. Wydawnictwa AGH.
3. Lenda G., Marmol U., Mirek G., 2015. Accuracy of laser scanners for measuring surfaces made of synthetic materials. Photogrammetrie Fernerkundung Geoinformation 5, pp. 357–372.
4. Wojciech Drzewiecki, Piotr Wężyk, Marcin Pierzchalski, Beata Szafrańska, 2014. Quantitative and qualitative assessment of soil erosion risk in Małopolska (Poland), supported by an object-based analysis of high-resolution satellite images. Pure and Applied Geophysics, vol. 171 iss. 6, pp. 867–895
5. Drzewiecki W., Mularz S, 2008: Simulation of water soil erosion effects on sediment delivery to Dobczyce Reservoir. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, ol. 37 Pt. B8 Commission 8, pp. 787–793

Learning outcomes prescribed to a field of study

Code	Content
RSGI2A_K01	is ready to resolve conflicts, negotiate, work in a team
RSGI2A_K02	is ready for creative time management, working under time pressure
RSGI2A_U02	can acquire remote environmental data
RSGI2A_U03	is able to process geospatial data and automate data processing in an advanced manner
RSGI2A_U04	is able to use IT tools for spatial data processing
RSGI2A_W01	has a deep knowledge of mathematics in remote sensing data analysis
RSGI2A_W04	has a deep understanding of methods, algorithms and automation of spatial data processing
RSGI2A_W05	has an enhanced knowledge of the use of computer science in geoscience