Hyperspectral Remote Sensing
Course description sheet

Basic information

Field of study Geodesy, Surveying and Cartography	**Didactic cycle** 2024/2025
Major Geoinformation, Photogrammetry and Remote Sensing	**Course code** DGIKGFS.IIi4.01633.24
Organisational unit Faculty of Geo-Data Science, Geodesy, and Environmental Engineering	**Lecture languages** English
Study level Second-cycle (engineer) programme	**Mandatoriness** Elective
Form of study Full-time studies	**Block** Elective Modules in Foreign Language
Profile General academic	**Course related to scientific research** Yes

Course coordinator	Ewa Głowienka

Lecturer	Ewa Głowienka

Period Semester 3	**Method of verification of the learning outcomes** Completing the classes **Activities and hours** Project classes: 30	**Number of ECTS credits** 3

Goals

C1	The aim of the module is to introduce students to hyperspectral remote sensing techniques and the possibilities of applying these methods to various land cover/land use monitoring tasks.

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	has knowledge about hyperspectral images processing	GIK2A_W02, GIK2A_W05, GIK2A_W06	Activity during classes, Participation in a discussion, Execution of a project, Project, Involvement in teamwork, Presentation
W2	has knowledge about hyperspectral data acquiring and application	GIK2A_W05, GIK2A_W06, GIK2A_W07	Activity during classes, Participation in a discussion, Execution of a project, Project, Involvement in teamwork, Presentation
Skills – Student can:			
U1	has ability to hyperspectral image processing	GIK2A_U03, GIK2A_U04, GIK2A_U08, GIK2A_U09	Activity during classes, Participation in a discussion, Execution of a project, Project, Involvement in teamwork, Presentation
Social competences – Student is ready to:			
K1	has ability to acquire a new knowledge	GIK2A_K01	Activity during classes, Participation in a discussion, Execution of a project, Project, Involvement in teamwork, Presentation

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

The module is designed to provide knowledge about the possibilities of remote sensing applications in solving tasks carried out by various fields. In the module, the student will learn about hyperspectral data registered from ground, airborne and satellite levels. Students will learn to use hyperspectral remote sensing data in monitoring selected elements of the surrounding.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Project classes	30
Realization of independently performed tasks	10
Contact hours	5
Preparation of project, presentation, essay, report	30
Examination or final test/colloquium	2

Student workload	Hours 77
Workload involving teacher	Hours 30

* hour means 45 minutes

Program content

No.	Program content	Course's learning outcomes	Activities
1.	Preprocessing of hyperspectral data: Initial correction of hyperspectral images: correction of atmospheric and topographical effect. Radiometric correction. Terrestrial hyperspectral data processing.	W1, W2, U1, K1	Project classes
2.	Data extraction: Image classification, applying special methods and algorythms dedicated hyperspactral image processing basing on the in-situ spectrometer data.	W1, W2, U1, K1	Project classes

Extended information/Additional elements

Teaching methods and techniques :

Discussion, E-learning, Case study, Problem Based Learning, Project Based Learning

Activities	Methods of verification	Credit conditions
Project classes	Activity during classes, Participation in a discussion, Execution of a project, Project, Involvement in teamwork, Presentation	

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

Project exercises include the training of practical application of the knowledge and are mandatory. Credit is based on student's activity.

Method of determining the final grade

final score = score of project

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.

Prerequisites and additional requirements

basic knowledge of remote sensing

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

Project classes: Project exercises: Students carry out practical work aimed at achieving the competences assumed by the syllabus. The manner in which the project is carried out and the final result are assessed.

Literature

Obligatory

1. ENVI Tutorial
2. Hyperspectral Imaging http://www.microimages.com/getstart/pdf/hyprspec.pdf
3. Hejmanowska B. Wężyk P., 2021 (red.) Satellite data for public administration (in Polish), Polska Agencja Kosmiczna, © Copyright by Polska Agencja Kosmiczna 2020

Optional

1. Lillesand T.M., Kiefer R.W.: Remote Sensing and Image Interpretation. John Wiley &amp; Sons, 2004

Scientific research and publications

Research

1. 2020-2022 Integration of remote sensing data for control in the agricultural direct payments system (IACS), Excellence Initiative - Research University - AGH

Publications

1. Glowienka E., Zembol N.: Forest Community Mapping Using Hyperspectral (CHRIS/PROBA) and Sentinel-2 Multispectral Images. Geomatics and Environmental Engineering 16(4):103-117, 2022, DOI: 10.7494/geom.2022.16.4.103
2. Hejmanowska, B.; Kramarczyk, P.; Głowienka, E.; Mikrut, S. Reliable Crops Classification Using Limited Number of Sentinel-2 and Sentinel-1 Images. Remote Sens. 2021, 13, 3176. https://doi.org/10.3390/rs13163176 3.
3. Michałowska M., Głowienka E.: Multi-Temporal Analysis of Changes of the Southern Part of the Baltic Sea Coast Using Aerial Remote Sensing Data. 2022, Remote Sensing 14(5), http://dx.doi.org/10.3390/rs14051212

Learning outcomes prescribed to a field of study

Code	Content
GIK2A_K01	działania w sposób kreatywny i przesiębiorczy z uwzględnieniem krytycznej oceny posiadanej wiedzy i potrzeby konsultacji eksperckich
GIK2A_U03	samodzielnie planować i realizować własne uczenie się w szczególności w zakresie dyscypliny naukowej właściwej dla geodezji i kartografii,
GIK2A_U04	planować i przeprowadzać eksperymenty z wykorzystaniem zaawansowanych metod analitycznych i symulacyjnych oraz formułować, projektować i rozwiązywać skomplikowane zadania inżynierskie, prawidłowo szacując nakład pracy i koszty realizacji, a także rozumiejąc ich znaczenie
GIK2A_U08	ocenić przydatność i możliwości wykorzystania nowych technik i technologii pozyskiwania danych przestrzennych oraz zaawansowanych narzędzi informatycznych służących do przetwarzania i analizy wyników obserwacji, dokonać krytycznej analizy ich funkcjonowania i zaproponować usprawnienia istniejących rozwiązań
GIK2A_U09	rozwiązywać złożone zadania inżynierskie z zakresu wybranej specjalności na kierunku Geodezja i Kartografia, stosując nowoczesne metody i uwzględniając komponent badawczy, w tym dokonać identyfikacji i sformułować specjalistyczną specyfikację zadania oraz opracować procedurę realizcji uwzględniając aspekty pozatechniczne
GIK2A_W02	najnowsze osiągnięcia i trendy rozwojowe w dziedzinach i dyscyplinach naukowych, właściwych dla dyscypliny naukowej Inżynieria lądowa i transport
GIK2A_W05	metody, techniki, narzędzia i materiały stosowane przy rozwiązywaniu złożonych zadań inżynierskich z dziedziny geodezja i kartografia oraz dziedzin pokrewnych
GIK2A_W06	specjalistyczne metody pozyskiwania, analizowania, modelowania i wizualizowania danych przestrzennych i zmian tych danych spowodowanych procesami naturalnymi i technologicznymi
GIK2A_W07	zasady planowania eksperymentów i symulacji komputerowych oraz zasady interpretowania uzyskanych wyników