GIS for Decision Support System (DSS)

Course description sheet

Basic information

Field of study Geospatial Computer Science **Major** Remote Sensing and GIS **Organisational unit** Faculty of Geo-Data Science, Geodesy, and Environmental Engineering **Study level** Second-cycle (engineer) programme **Form of study** Full-time studies **Profile** General academic	**Didactic cycle** 2024/2025 **Course code** DGEITGS.IIi2.07206.24 **Lecture languages** English **Mandatoriness** Obligatory **Block** Major Modules **Course related to scientific research** Yes

Course coordinator	Wojciech Drzewiecki
Lecturer	Wojciech Drzewiecki, Piotr Cichociński

Period	**Method of verification of the learning outcomes**	**Number of ECTS credits**
Semester 2	Completing the classes **Activities and hours** Lectures: 15 Project classes: 30	3

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 Spatial Decision Support Systems and their application areas	GEI2A_W03	Test

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
W2	knows and understand the role of GIS in Multicriteria Decision Analysis and Spatial Decision Support Systems	GEI2A_W03	Test
W3	knows GIS technologies useful for SDSS and possibilities of their application for decision support	GEI2A_W03	Test
W4	has knowledge about sources of uncertainty in GIS analysis and uncertainty influence on GIS analysis outputs	GEI2A_W03	Test
Skills – Student can:			
U1	can implement GIS analysis for multiattribute and multiobjective decision support	GEI2A_U01, GEI2A_U05	Execution of exercises, Project
U2	can evaluate the impact of different uncertainty sources on spatial analysis outputs	GEI2A_U01, GEI2A_U05, GEI2A_U07	Execution of exercises, Project
Social competences – Student is ready to:			
K1	use the Spatial Decision Support Systems responsibly	GEI2A_K01	Execution of a project

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

Student will aquire the knowledge and skills related to application of GIS technologies for supporting spatial decisions. The important part of the module is dedicated to uncertainty assessment.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Lectures	15
Project classes	30
Preparation for classes	8
Examination or final test/colloquium	2
Contact hours	2
Preparation of project, presentation, essay, report	20
Student workload	**Hours** 77
Workload involving teacher	**Hours** 45

* hour means 45 minutes

Program content

No.	Program content	Course's learning outcomes	Activities
1.	Introduction to Multicriteria Decision Analysis and Spatial Decision Support Systems. The role of GIS: historical backround and recent progress. GIS in multiattribute and multiobjective decision analysis. Decision making under uncertainty: sources of uncertainty, modeling error and uncertainty in GIS, fuzzy methods, probabilistic methods, sensitivity analysis. GIS technologies in Spatial Decision Support: Desktop GIS, Geovisualization, WebGIS, Collaborative and Participatory GIS, MobileGIS, machine learning and deep learning techniques in Spatial Decision Support.	W1, W2, W3, W4, K1	Lectures
2.	Implementation of GIS for spatial decision support. Uncertainty assessment in GIS analysis. Application of machine learning and deep learning techniques to spatial analyses and decision support - demostration of examples and hands-on activities.	U1, U2, K1	Project classes

Extended information/Additional elements

Teaching methods and techniques :

Project Based Learning, Problem Based Learning, E-learning, Group work, Discussion, Lectures, Demonstration

Activities	Methods of verification	Credit conditions
Lectures	Execution of a project, Test	
Project classes	Execution of exercises, Execution of a project, Project	

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

Credit of the project clases on the basis of attendance at classes and a positive evaluation of the project reports. In case of project classes a final grade is calculated as an average of individual project grades. A student who fails the project report evaluation may proceed to a resit twice.

Method of determining the final grade

Final grade = 0.7*project clsses grade + 0.3* final test grade Both, project and final test, has to be graded at least 3.0

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

Prerequisities: basic knowledge of GIS.

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

obligatory

Lectures: students participate in the class by learning the subsequent teaching content according to the course syllabus. Students should ask questions and clarify doubts on an ongoing basis. Audio-visual recording of the lecture requires the consent of the instructor. Project classes: students perform practical work aimed at achieving the competencies assumed by the syllabus. The manner of execution of the project and the final result are evaluated.

Literature

Obligatory

1. Malczewski J., Rinner C.: Multicriteria Decision Analysis in Geographic Information Science. Springer 2015
2. Sugumaran R., DeGroote J.: Spatial Decision Support Systems. Principles and Practices. CRC Press 2011.

Scientific research and publications

Publications

1. Pirowski T., Drzewiecki W., Orzińska E.: Simple method for incorporation of topographical factor into GIS-supported multi-variant rail route selection. W: SGEM 2014 : GeoConference on Informatics, geoinformatics and remote sensing: international multidisciplinary scientific geoconference : 17–26 June, 2014, Albena, Bulgaria : conference proceedings. Vol. 3, Photogrammetry and remote sensing cartography and GIS. — Sofia : STEF92 Technology Ltd., 841-851.
2. Wojciech DRZEWIECKI, Sebastian Ziętara: Wpływ algorytmu określania dróg spływu powierzchniowego na wyniki oceny zagrożenia gleb erozją wodną w skali zlewni z zastosowaniem modelu RUSLE - The influence of flow routing algorithm on the results of RUSLE-based catchment-wide erosion risk assessment. Roczniki Geomatyki = Annals of Geomatics / Polskie Towarzystwo Informacji Przestrzennej, 2013 t. 11 z. 1, s. 57–68
3. Wojciech Drzewiecki, Emilia Orzińska, Tomasz Pirowski:Analizy przestrzenne jako wsparcie projektowania przebiegu infrastrukturalnych obiektów liniowych — Spatial analyses environment as a supporting tool for infrastructural linear object routing. Roczniki Geomatyki = Annals of Geomatics /2012 t. 10 z. 4, s. 65–76
4. Drzewiecki W., Hejmanowska B., Pirowski T.: Przykładowe analizy przestrzenne w oparciu o komputerowy atlas Województwa Krakowskiego KAWK, Archiwum Fotogrametrii, Kartografii i Teledetekcji, Vol.9. Polska, Olsztyn 1999;

Learning outcomes prescribed to a field of study

Code	Content
GEI2A_K01	samodoskonalenia, a także postępowania profesjonalnego, odpowiedzialnego i zgodnego z zasadami etyki zawodowej.
GEI2A_U01	stosować zaawansowane metody pozyskiwania, integracji i przetwarzania informacji pochodzących z różnych źródeł danych.
GEI2A_U05	formułować i rozwiązywać zadania przestrzenne, posługując się zaawansowanymi funkcjami analitycznymi, w tym implementować adekwatne algorytmy obliczeniowe.
GEI2A_U07	wykorzystywać i automatyzować specjalistyczne metody analiz oraz symulacji dla celów modelowania i rozwiązywania problemów z zastosowaniem geoinformacji.
GEI2A_W03	zaawansowane metody i techniki, w tym teledetekcyjne, stosowane do pozyskiwania i przetwarzania danych przestrzennych i środowiskowych na potrzeby geoinformacji.