



Subject card

Subject name and code	Advanced geoinformation methods, PG_00069059						
Field of study	Geodesy and Cartography						
Date of commencement of studies	February 2026		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Geodesy -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Adam Inglot				
	Teachers		dr inż. Adam Inglot				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	45		0.0		0.0	45
Subject objectives	Students become familiar with the design and execution of advanced spatial analyses in a GIS environment using Python. Over the course, they master programming fundamentals, working with the arcpy library, performing raster and vector analyses through scripts, and the basics of point-cloud processing (LAS/LAZ) with laspy , developing the ability to build reproducible workflows and to document results rigorously.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U06] creates solutions to complex and unstructured problems taking into account the variability of the environment by synthesising information from different sources, using analytical and simulation methods		Formulates and solves an unstructured geoinformatics problem: defines objectives, criteria, and constraints; selects appropriate analytical/simulation methods; and iteratively updates assumptions in response to data and environmental variability.		[SU5] Assessment of ability to present the results of task		
	[K7_W05] has a well-established knowledge of analytical methods and surveying techniques necessary for creating and solving a variety of problems in geodesy and cartography		Has a solid knowledge of modern surveying techniques (GNSS, photogrammetry, ALS/TLS scanning) and of how to integrate them with GIS data to solve complex spatial problems.		[SW3] Assessment of knowledge contained in written work and projects		
Subject contents	Course content – lecture						
	The lectures cover advanced methods of spatial data analysis and modeling in GIS environments. The course presents modern approaches to integrating measurement data (GNSS, orthophotos, ALS/TLS scans) with geospatial datasets and performing complex analyses. Students learn about data quality assessment, uncertainty estimation, and spatial modeling methods, including network analyses and cost-distance modeling. Emphasis is placed on the design and automation of geoinformatics workflows using Python, arcpy, and geopandas, as well as on documenting and interpreting analytical results. The lectures focus on developing critical thinking and the ability to plan reproducible analytical processes.						
	Course content – laboratory						
	The laboratory classes focus on the practical implementation of spatial analyses in Python and GIS. Students develop scripts to automate vector and raster operations, perform network and cost-path analyses, and process point clouds (LAS/LAZ) using libraries such as laspy. They generate elevation products such as DTM, DSM, and CHM, integrate multisource data, and evaluate their quality and consistency. The final stage of the laboratory involves creating cartographic outputs and analytical reports. The main objective is to develop the ability to independently design, automate, and document geoinformatics workflows using modern analytical tools.						

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project	50.0%	100.0%
Recommended reading	Basic literature	1. P. A. Longley, M. F. Goodchild, D. J. Maguire, D. W. Rhind - GIS. Teoria i praktyka. Wydawnictwo Naukowe PWN, Warszawa, 2008 2. J. Urbański - GIS w badaniach przyrodniczych. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, 2008 3. J. Adamczyk, K. Będkowski - Metody cyfrowe w teledetekcji, Wydawnictwo SGGW, Warszawa, 2007 4. R. J. Wilson Wprowadzenie do teorii grafów, Wydawnictwo Naukowe PWN, Warszawa 2012 5. J. Smith, P. Smith - Environmental modeling an introduction, Oxford University Press, 2007	
	Supplementary literature	1. Bonaccorso, Giuseppe. <i>Machine learning algorithms</i>. Packt Publishing Ltd, 2017. 2. Toms, Silas. <i>ArcPy and ArcGISGeospatial Analysis with Python</i>. Packt Publishing Ltd, 2015. 3. Beyeler, Michael. <i>Machine Learning for OpenCV</i>. Packt Publishing Ltd, 2017.	
	eResources addresses		
	Example issues/ example questions/ tasks being completed	• GIS data models (vector/raster/DTM/DSM/CHM) and data quality/uncertainty. • Network analyses: cost-distance, shortest path, route variants. • Point-cloud processing (LAS/LAZ): filtering, DTM/DSM/CHM. • Integration of GNSS/orthophotos/ALS, georeferencing and fit control. • Workflow automation in Python (arcpy, geopandas, rasterio, laspy).	
Practical activities within the subject	Not applicable		

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