GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Low-level aerial remote sensing, PG_00053258						
Field of study	Geodesy and Cartography						
Date of commencement of studies	October 2022		Academic year of realisation of subject	2024/2025			
Education level	first-cycle studies		Subject group	Optional subject group Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department Of Geodesy -> Faculty Of Civil And Environmental Engineering -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jakub Szulwic					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	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		5.0	25.0	75	
Subject objectives	The aim of the course is to familiarise students with the fundamentals of acquiring, processing, and interpreting remote sensing data collected from low-altitude platforms, particularly unmanned aerial vehicles (UAVs). Students gain an understanding of the physical principles of electromagnetic imaging and the technical characteristics of multispectral and thermal imagery. Emphasis is placed on the creation of remote sensing-specific analytical products, such as vegetation and moisture index maps, land cover classifications, thermal distribution maps, and terrain surface analyses. The course develops the ability to select appropriate spectral analysis and thematic classification methods for specific research or application-oriented objectives.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W07] has a well-established knowledge and understands concepts in the field of engineering geodesy including the use of calculations and measurements methods carried out with the use of geodetic instruments and photogrammetric and remote sensing technologies related to geodetic support for investment, surveying and inventory measurements and photogrammetry with remote sensing	The student has knowledge of the fundamental physical principles of remote sensing. They are familiar with selected methods of data acquisition from UAV (Unmanned Aerial Vehicle), aerial, and satellite platforms. They possess basic knowledge regarding the digital processing and analysis of low-altitude images (multispectral, thermal). They are knowledgeable about the methods for creating basic remote sensing products.	[SW1] Assessment of factual knowledge
[K6_U14] can apply the necessary skills to conduct independent work in the field of topographic surveys along with the elaborating of results, geodetic investment service, surveying and inventory measurement, photogrammetry and remote sensing, and making the maps and elaborations for legal purposes including delimitation and subdivision of real estate	The student possesses basic skills in digital processing of remote sensing data. They are capable of applying image classification methods, calculating indices, and using color compositions to create thematic maps.	[SU4] Assessment of ability to use methods and tools
[K6_U04] can use contemporary geodetic instruments, including automation of measurements, data transmission and processing in a computer-instrument system with the use of computer networks	The student is capable of utilizing methods of digital processing of remote sensing images for creating orthophotomaps, filtering, calibration, classification, calculating indices, and generating thematic maps.	[SU1] Assessment of task fulfilment
[K6_W01] has basic knowledge and understands the concepts of physics which allow to use optical and immersive instruments as well as positioning and satellite imaging	The student knows and understands the principles applicable during the acquisition, processing, and analysis of low-altitude remote sensing data.	[SW1] Assessment of factual knowledge

Subject contents

The course covers the fundamentals of electromagnetic radiation and digital image characteristics in the context of UAV-based remote sensing. It introduces various types of low-altitude remote sensing data, including multispectral and thermal imagery, with a focus on spatial, spectral, and radiometric resolution. Students explore data acquisition methods using passive and active sensors, operations on spectral bands, generation of false-colour composites, computation of thematic indices (e.g. NDVI, NDWI, SAVI), and land cover classification techniques. The curriculum also includes thermal data processing, temperature mapping, moisture analysis, and surface modelling based on derived digital terrain models (DTMs), such as slope, aspect, and solar exposure analyses.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Student's project	60.0%	30.0%
Test	60.0%	40.0%
Report	60.0%	30.0%

Recommended reading

Basic literature	• Adamczyk J., Będkowski K.: Metody cyfrowe w teledetekcji. Wydawnictwo SGGW, Warszawa 2005 • Kurczyński Z.: Lotnicze i satelitarne obrazowanie Ziemi; Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006 • Bernasik J.: Wykłady z fotogrametrii i teledetekcji, Kraków 2008 • Sanecki J. (red): Teledetekcja: Pozyskiwanie danych. WNT, 2006
Supplementary literature	• Noor, N. M., Abdullah, A., & Hashim, M. (2018, June). Remote sensing UAV/drones and its applications for urban areas: A review. In *IOP conference series: Earth and environmental science* (Vol. 169, No. 1, p. 012003). IOP Publishing. • Mazur, P., & Chojnacki, J. (2017). Wykorzystanie dronów do teledetekcji multispektralnej w rolnictwie precyzyjnym. *Technika rolnicza ogrodnicza leśna (1)* • Tang, L., & Shao, G. (2015). Drone remote sensing for forestry research and practices. *Journal of Forestry Research*, *26*, 791-797.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	• What physical phenomena enable UAV sensors to register multispectral and thermal data? • How do spectral and radiometric resolution influence the precision of vegetation and moisture index analysis? • How should a UAV mission be designed depending on the thematic purpose of the study? • What spectral band processing methods are suitable for reliable index map generation? • How can remote sensing indices (NDVI, NDWI, NDMI, SAVI) be calculated and interpreted for agricultural or urban areas? • In what ways can thermal imagery be used for detecting local heat sources or assessing microclimate patterns? • What are effective methods for land cover classification using low-altitude UAV data? • How can spatial analysis based on UAV-derived data (e.g. flood risk, solar exposure) support decision-making in environmental or urban planning?
Work placement	Not applicable

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