GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00066179		
Field of study	Geodesy and Cartography		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
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	1	ECTS credits	8.0
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. Jakub Szulwic	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	45.0	30.0	0.0	0.0	120
	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	120	0.0	0.0	120

Subject objectives

The aim of the course is to prepare students for the independent planning and evaluation of advanced photogrammetric projects in accordance with current technological, methodological, and legal standards. Particular emphasis is placed on the principles of data acquisition and processing from high-altitude, crewed aerial platformscovering both classical analogue approaches and modern digital techniques used in national and international mapping programmes.

The course explores contemporary methods for flight planning, geometric and radiometric modelling of imagery, aerotriangulation, generation of orthophotos and digital terrain models, as well as accuracy assessment and quality control. Core theoretical content is complemented by topics related to the integration of photogrammetric data with Geographic Information Systems (GIS) and Building Information Modelling (BIM).

Additionally, the course addresses data acquisition from unmanned aerial vehicles (UAVs), mobile mapping systems, close-range terrestrial photogrammetry, and terrestrial laser scanningas complementary technologies used in engineering, documentation, and environmental applications.

The curriculum also includes a review of applicable legal regulations and industry standards governing the use of photogrammetric methods in Poland and the European Union.

The course provides students with a comprehensive understanding of modern photogrammetric techniques and prepares them for their informed application in both academic and professional contexts.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W01] has the knowledge of basic aerial and satellite photogrammetry and extensive knowledge of the application of photogrammetry, including knowledge of the usage of photogrammetric methods and technologies of data acquisition for the construction of topographic and thematic databases,has the knowledge of numerical terrain models (NMT) and numerical models of land cover (NMPT), as well as building models; knows and is able to apply in practice photogrammetric techniques and technologies, and in particular knows the principles of image mapping, vector maps and altitudinal models, has knowledge of existing sensors and their calibration, terratriangulation of models and 3D visualization	The student acquires foundational knowledge in aerial and satellite photogrammetry, along with extended understanding of its applications in the development of topographic and thematic databases. They learn the principles of generating image maps, vector maps, and elevation models, including digital terrain models (DTM), digital surface models (DSM), and 3D building models. The course covers sensor calibration, image geometry, model orientation and block adjustment, as well as methods for 3D visualisation.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_U05] can choose, depending on the nature of the study, methods for assessing the quality of photogrammetric and remote sensing products and elaborations.	The student learns criteria and methods for assessing the quality of photogrammetric and remote sensing products, including geometric accuracy, radiometric consistency, and data completeness. They are able to select appropriate quality control techniques based on the type of application and compare different image-based products in terms of their suitability for specific tasks.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K7_W02] knows the basics of data acquisition using laser scanning, has the knowledge of the block alignment (scan orientation); knows methods for assessing the quality of photogrammetric and remote sensing products; knows the Act of May 17, 1989 - Geodetic and cartographic law, together with its implementing provisions	The student learns methods for processing laser scanning data to create 3D models, including point cloud filtering, object classification, and surface reconstruction. They apply advanced techniques for analysing and adjusting geodetic observations, including least squares methods, error detection, and accuracy and reliability assessment of measurements.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_U02] can perform and elaborate 3D models based on laser scaninng data; can apply methodologies in advanced geodetic observation	The student becomes familiar with digital image processing techniques used in photogrammetry and remote sensing, with particular focus on geometric and radiometric correction, filtering, segmentation, and feature extraction. They learn algorithms for 3D reconstruction, orthophoto generation, and surface modelling. The student also develops skills in assessing image quality and preparing data for further analysis within GIS and BIM environments.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
	[K7_U04] can use the techniques of digital image processing in digital photogrammetry and remote sensing	The student becomes familiar with digital image processing techniques used in photogrammetry and remote sensing, with particular focus on geometric and radiometric correction, filtering, segmentation, and feature extraction. They learn algorithms for 3D reconstruction, orthophoto generation, and surface modelling. The student also develops skills in assessing image quality and preparing data for further analysis within GIS and BIM environments.	[SU4] Assessment of ability to use methods and tools

Course outcome	Subject outcome	Method of verification
[K7_U01] can use in the practice photogrammetric techniques and technologies and in particular knows the principles of creating image maps, vector maps and elevation models; is able to carry out photogrammetric engineering measurements	The student becomes familiar with advanced techniques for acquiring and processing image data from crewed, uncrewed, and mobile platforms. They learn the principles of generating orthophotos, vector maps, and elevation models, including aerotriangulation, geometric modelling of imagery, and accuracy analysis. Particular emphasis is placed on engineering applications of photogrammetry, integration with GIS and BIM systems, and understanding current technical standards and legal regulations.	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information

Subject contents

Course content – lecture
The course covers advanced methods of image data acquisition and processing in digital photogrammetry. Topics include the principles of planning photogrammetric missions for crewed and uncrewed aerial systems, image geometry modelling, aerotriangulation, and techniques for generating orthophotos, vector maps, and elevation models. Special attention is given to the construction and analysis of digital terrain models (DTM), digital surface models (DSM), and three-dimensional representations of objects.

The curriculum also addresses data processing from mobile laser scanning systems, sensor calibration, and evaluation of image data quality. Students become familiar with methods for assessing the accuracy and reliability of photogrammetric and remote sensing products. Legal frameworks regulating photogrammetric measurements, documentation standards, and the use of data in spatial information systems and BIM environments are also discussed.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Assessment of factual knowledge in the form of written work and an interview.	60.0%	60.0%
Evaluation of a practical study in the form of a photogrammetric project.	50.0%	40.0%

Recommended reading

Basic literature	1. Kurczyński Z, Lotnicze i satelitarne obrazowanie Ziemi tom 1 i 2, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2006 2. Kurczyński Z., Preuss R.: "Podstawy Fotogrametrii", Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2002 3. Butowtt J., Kaczyński R: "Fotogrametria", Wojskowa Akademia Techniczna, Warszawa, 2003 4. Sitek Z.: "Zarys teledetekcji lotniczej i satelitarnej" Wydawnictwa AGH, Kraków, 1992
Supplementary literature	Kraus K.: Photogrammetry: geometry from images and laser scans - fragmenty Krystian Pyka: Podstawy fotogrametrii https://epodreczniki.open.agh.edu.pl/handbook/1486
eResources addresses	

Example issues/ example questions/ tasks being completed	• What are the fundamental principles of photography applied in photogrammetry, and how do they affect image quality? • How to select flight parameters (altitude, overlap, GSD) for crewed and uncrewed photogrammetric missions? • How to design and implement a professional photogrammetric flight in various spatial and technological contexts? • What are the differences between analogue, digital, metric, and non-metric sensors, and how do they impact data processing? • What is aerotriangulation, and how can the geometric quality of a block be evaluated? • How are orthophotos, vector maps, and elevation models generated from image data? • What are the methods for generating and classifying point clouds and constructing 3D models of terrain and structures? • How to assess the quality of photogrammetric and remote sensing products in terms of geometric accuracy, radiometric consistency, and data completeness? • How to compare the usefulness of different image-based products for engineering documentation and environmental analysis? • What are the legal and technical requirements for conducting photogrammetric work in Poland and the European Union?
Practical activites within the subject	Not applicable

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