GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Remote Sensing, PG_00061767		
Field of study	Geodesy and Cartography		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	4.0
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. Anna Sobieraj-Żłobińska	
	Teachers	mgr inż. Monika Gierszewska dr inż. Anna Sobieraj-Żłobińska	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0	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	10.0	45.0	100

Subject objectives	Getting to know the methods of remote data acquisition, digital image processing techniques and creating selected remote sensing studies.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U08] can use modern measurement technologies to solve common tasks in 3D modeling	The student has knowledge and skills in the use of remote sensing methods and technologies for information extraction and data acquisition for the construction of thematic databases.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[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 has basic skills in digital processing of remote sensing data. He can use the methods of image classification, calculation of indices, color compositions to create thematic maps.	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[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 physical basics of remote sensing. He knows selected methods of acquiring data from the airborne and satellite platforms. He also has basic knowledge of digital processing and analysis of aerial and satellite images. He has knowledge of the methods of creating basic remote sensing products.	[SW1] Assessment of factual knowledge

Subject contents	Course content – lecture **Introduction to Remote Sensing** Definition and scope of remote sensing. The role of remote sensing within geodetic and cartographic sciences. Development trends and fields of application. **Physical Foundations of Remote Sensing** Electromagnetic radiation: spectrum range and its division. Interaction of radiation with the atmosphere and the Earths surface (reflection, absorption, transmission). Spectral characteristics of objects spectral curve and spectral signature. **Characteristics of Remote Sensing Imagery** Multispectral imagery. The concept of a pixel and Digital Number (DN). Types of resolution: spatial, spectral, radiometric, and temporal, and their significance for image interpretation. **Sources and Methods of Remote Sensing Data Acquisition** Airborne, satellite, and unmanned aerial vehicle (UAV) data. Passive and active methods (radar, LiDAR laser scanning). Characteristics of selected satellite systems, in particular the Copernicus programme and the Sentinel-2 and Landsat 8 missions. **Pre-processing of Remote Sensing Data** Geometric and radiometric corrections. Fundamentals of atmospheric correction. Raster data transformations. **Operations on Spectral Bands** Creation of colour composites (natural and false colour). Selection of spectral bands depending on the purpose of analysis. Fundamentals of visual image interpretation. **Spectral Indices in Environmental Analyses** Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), and other thematic indices. Interpretation of index values and their application in spatial analyses. **Classification of Multispectral Images** Fundamentals of pixel-based and object-based classification. Unsupervised and supervised classification. Training data selection. Accuracy assessment of classification results (confusion matrix, accuracy measures). Course content – project **Acquisition and Organization of Remote Sensing Data** Downloading satellite data (Sentinel, Landsat). Data quality verification and preparation for analysis. **Visualization and Analysis of Spectral Bands** Displaying individual bands. Analysis of histograms and radiometric ranges. Assessment of contrast and the impact of spatial resolution. **Preparation of Colour Composites** Creation of natural colour and false colour composites. Interpretation of land cover based on spectral composites. **Calculation of Spectral Indices** Derivation of NDVI and other thematic indices. Spatial analysis of the obtained results. **Comparative Analysis of Data with Different Resolutions** Comparison of imagery from different satellite systems. Data resampling. Evaluation of imagery suitability for specific geodetic and cartographic applications. **Unsupervised Classification of Multispectral Imagery** Pixel grouping using a selected algorithm. Interpretation of the resulting thematic classes. **Supervised Classification of Multispectral Imagery** Selection of training areas. Implementation of classification. Accuracy assessment using a confusion matrix. **Preparation of a Thematic Map** Cartographic editing of classification results or index-based analyses. Design of the legend and map layout, and export of the final product to a publication format. **Final Project** Comprehensive analysis of a selected area including data preparation, spectral analysis, classification, and preparation of a thematic map accompanied by a technical report documenting the

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<tr><td></td><td>applied methodology and interpretation of results.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of mathematics and physics.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>project</td><td>60.0%</td><td>35.0%</td></tr>
<tr><td>report</td><td>60.0%</td><td>15.0%</td></tr>
<tr><td>exam</td><td>60.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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

Sanecki J. (red): Teledetekcja: Pozyskiwanie danych. WNT, 2006</td></tr>
<tr><td>Supplementary literature</td><td>Bernasik J.: Wykłady z fotogrametrii i teledetekcji, Kraków 2008,

Mulasz S.: Podstawy z teledetekcji. Wprowadzenie do GIS. Wydawnictwo PK, 2004</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Interpretation of the NDVI

Development of a thematic map for a selected area using the results of classification</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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