



## Subject card

Subject name and code	Mathematical methods of geodetic observation processing B, PG_00040002						
Field of study	Geodesy and Cartography						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2024/2025		
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			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Geodesy -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marek Zienkiewicz					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	10.0	0.0	0.0	0.0	25
	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	25	7.0		18.0		50
Subject objectives	Acquainting and discussing issues related to standard and unconventional methods of developing geodetic observations						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W13] knows advanced models of geodetic surveying, theoretical foundations of non-standard estimation methods, free and multi-step equations (sequential) adjustment methods	The student has a well-established knowledge of the theory of the least squares method and non-standard estimation methods. He knows the methods of developing geodetic data in both classical and free observation systems. The student also has knowledge of the diagnosis of observational material in the context of gross errors in measurements.			[SW1] Assessment of factual knowledge		
	[K7_U09] can apply methodologies in advanced geodetic observation	The student correctly uses the algorithms of the least squares method and non-standard estimation methods to develop geodetic observations. He analyzes the obtained results and correctly draws conclusions about the tested measurement structure			[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
Subject contents	Lecture topics: 1. Methods of analyzing the quality of geodetic observations, 2. Robust M-estimation and its application in geodetic measurement practice, 3. Sequential adjustment of geodetic observations, 4. Kalman filtering in the process of predicting changes in the position of navigational and engineering objects.  Exercises: Detection and localization of outlier observations in observation material using the Baardy approach. Robust adjustment of geodetic network using the Huber method. Sequential adjustment of observations using the least squares method. Prediction of changes in the position of geodetic network points using the Kalman filter.						
Prerequisites and co-requisites	Basics in the field of matrix calculus. Adjustment of observations by the classical and free versions of the least squares method.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final test	50.0%	80.0%
	practical exercises	100.0%	20.0%
Recommended reading	Basic literature	Wiśniewski Z. 2016. Rachunek wyrównawczy w geodezji z przykładami, Wiśniewski Z. 2013. Zaawansowane metody opracowania obserwacji geodezyjnych z przykładami	
	Supplementary literature	Koch K.R. 1999. Parameter estimation and hypothesis testing in linear models, Caspary W. 2000. Concepts of network and deformation analysis. The University of New South Wales, Kensington	
	eResources addresses	Adresy na platformie eNauczenie: Matematyczne metody opracowania obserwacji geodezyjnych B - Moodle ID: 41917 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=41917">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=41917</a>	
Example issues/ example questions/ tasks being completed	Robust adjustment of the geodetic network by using the Huber method, Detection and localization of gross errors in the observation material by using the Baardy method.		
	Application of the Kalman filter in the process of predicting changes in the position of geodetic network points.		
Work placement	Not applicable		

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