GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Satellite and space navigation systems, PG_00044838		
Field of study	Geodesy and Cartography		
Date of commencement of studies	October 2023	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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. inż. Dariusz Tomaszewski	
	Teachers		

Lesson types

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	6.0	24.0	75

Subject objectives

The aim of the course is to familiarize students with the principles of operation of modern satellite navigation systems (GNSS) and their applications in geodesy and navigation. Students gain knowledge of system architecture, signal characteristics, and methods for determining the position of both receivers and satellites. The course also covers the analysis of measurement error sources and methods for their mitigation, including atmospheric corrections. Additionally, the objective is to develop skills in selecting appropriate positioning methods (absolute and differential) for specific engineering tasks, as well as the practical use of GNSS receivers and processing of measurement data.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U06] can solve geodetic tasks and select measurement methods for typical engineering tasks including the curvature of the Earth and the impact of gravity	The student is familiar with the available satellite positioning methods used in modern geodesy and is able to select an appropriate method for a given geodetic task.	[SU1] Assessment of task fulfilment
[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 able to use modern GNSS receivers for navigation and for performing geodetic tasks. The student can also process observations using international GNSS data exchange formats.	[SU4] Assessment of ability to use methods and tools
[K6_W03] knows and understands the principles of mathematical statistics described in the examples of the adjustment computations	The student knows and understands satellite measurement methods used in geodesy and navigation. They understand the mathematical model of absolute positioning (SPP) as well as differential positioning (kinematic/ static).	[SW3] Assessment of knowledge contained in written work and projects

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Classification and structure of modern GNSS positioning systems
GNSS satellite signals
Determination of satellite position in orbit
Determination of the absolute position of a receiver
Sources of errors in satellite measurements
Tropospheric correction
Ionospheric correction
Differential positioning
GNSS applications

Course content – laboratory
Generation of basic code for determining pseudorange (receiversatellite)
Practical determination of satellite position in space
Use of the SPP positioning model to determine receiver position
Determination of how satellite geometry affects the accuracy of GNSS receiver positioning
Determination of tropospheric correction values in satellite positioning (basic models)
Determination of ionospheric correction values in satellite positioning
Determination of tropospheric correction values in satellite positioning (advanced models)
Determination of differential GNSS positioning</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of least squares adjustment
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>A test covering the knowledge acquired during the course</td><td>60.0%</td><td>80.0%</td></tr>
<tr><td>Preparation of calculation reports</td><td>100.0%</td><td>20.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1) Alfred Leick, GPS SATELLITE SURVEYING, JOHN WILEY & SONS, 2004
2) Hoffmann-Wellenhof B., Lichtenegger H., Collins J.,, GPS Theory and Practice, SpringerWienNe</td></tr>
<tr><td>Supplementary literature</td><td>1) Misra P., Enge P., (2001), Global Positioning System Signals, Measurements, and Performance, Ganga - Jamuna Press, Lincoln, Massachusetts, USA - second edition (2006)"

2) Leick A., (1995), GPS Satellite Surveying, John Wiley & Sons. Inc</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Generation of the C/A code.
2. Determination of the navigation satellites position.
3. Determination of the receivers absolute position.
4. Calculation of the geometric DOP (Dilution of Precision) values.
5. Determination of the tropospheric delay using the Hopfield and Saastamoinen models.
6. Determination of the ionospheric correction from the brodcast data message.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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