



Subject card

Subject name and code	Geodesy and satellite navigation in transport , PG_00044578						
Field of study	Transport						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
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	3		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		exam		
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		prof. dr hab. inż. Mariusz Figurski				
	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						
	eNauczanie source addresses: Moodle ID: 8450 Geodezja i nawigacja satelitarna w transporcie https://enauczanie.pg.edu.pl/2025/course/view.php?id=8450						
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 provide students with knowledge of geodesy, satellite geodesy and satellite navigation in transport applications. Students learn reference and coordinate systems, the principles of GNSS/PNT, methods for determining position, velocity and time, as well as major error sources and techniques for improving positioning accuracy and reliability. The course covers GNSS applications in road, rail, maritime, aviation and unmanned transport, integration with inertial systems and other sensors, and issues related to navigation integrity and resilient PNT. The course also prepares students to select positioning methods appropriate to the requirements of a specific transport system, taking into account accuracy, availability, continuity, integrity and safety.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U06] able to plan and conduct simple laboratory and operational experiments and simulations in the area of transport; able to interpret the results and formulate conclusions	The student is able to plan and carry out measurements, experiments and simple simulations in the field of geodesy and satellite navigation for transport applications, as well as analyse and interpret the obtained results, assess the accuracy and reliability of position determination, and formulate conclusions regarding the suitability of the applied GNSS/PNT methods and technologies under specific transport conditions.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
	[K6_W03] has knowledge of informatics, electronics, telecommunications, automation and control, information technologies, computer graphics, geodesy and satellite navigation which is useful for understanding how it can be applied in transport	The student knows and understands the basic concepts, methods and technologies of geodesy and satellite navigation and their applications in transport systems, in particular the principles of GNSS/PNT operation, reference and coordinate systems, methods of determining position, velocity and time, as well as issues related to the accuracy, integrity, availability and resilience of positioning systems used in transport.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
Subject contents	Course content – lecture Fundamentals of geodesy and its role in transport. Reference and coordinate systems, map projections, GIS and spatial information. Time systems and synchronization. Fundamentals of celestial mechanics and navigation satellite orbits. GNSS signal propagation and the influence of the atmosphere and transport environment. Architecture and operation of GPS, GLONASS, Galileo and BeiDou. Positioning methods: SPP, DGNSS, RTK, PPP and PPP-RTK. GNSS augmentation systems, accuracy, integrity and error sources. Applications of geodesy and GNSS in road, rail, maritime, inland waterway, aviation and unmanned transport. GNSS/INS integration and multisensor positioning systems. Resilient PNT, jamming, spoofing and interference detection methods.		
	Course content – laboratory Surveying and data processing using GNSS receivers; GNSS solutions for the transportation sector.		
Prerequisites and co-requisites	Basic knowledge of mathematics, physics and computer science. Familiarity with fundamental concepts related to transport and measurement techniques.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory classes – completion of exercises, analysis of results, reports and/or short tests	50.0%	40.0%
	Final examination – theoretical and problem-solving part covering lecture content and interpretation of practical issues	50.0%	60.0%
Recommended reading	Basic literature	- Jan Sickle J., <i>GPS and GNSS for Land Surveyors</i>, 5th ed., CRC Press, 2023. Jest to bardzo dobre podstawowe źródło do części geodezyjnej i praktycznych metod GNSS. - Januszewski J., <i>Systemy satelitarne GPS, Galileo i inne</i>, Wydawnictwo Naukowe PWN, Warszawa, 2007. Publikacja jest adresowana m.in. do studentów transportu, nawigacji i geodezji. - Teunissen P.J.G., Montenbruck O. (eds.), <i>Springer Handbook of Global Navigation Satellite Systems</i>, Springer, 2017.	
	Supplementary literature	- Kaplan E.D., Hegarty C.J. (eds.), <i>Understanding GPS/GNSS: Principles and Applications</i>, 3rd ed., Artech House, 2017. Publikacja obejmuje m.in. błędy GNSS, pozycjonowanie różnicowe i PPP, zakłócenia oraz integrację GNSS z innymi sensorami. - Hofmann-Wellenhof B., Lichtenegger H., Wasle E., <i>GNSS – Global Navigation Satellite Systems: GPS, GLONASS, Galileo, and more</i>, Springer, 2008.	
	eResources addresses		

Example issues/ example questions/ tasks being completed	Example topics and tasks: • selection of reference and coordinate systems for transport applications; • analysis of GNSS operating principles and SPP, DGNSS, RTK and PPP positioning methods; • assessment of the impact of satellite geometry and propagation errors on positioning accuracy; • analysis of navigation solution integrity and reliability; selection of positioning techniques for road, rail, maritime and aviation transport; • analysis of GNSS/INS integration and multisensor systems; • identification of the effects of jamming and spoofing and methods for improving PNT resilience; • interpretation of measurement results and formulation of conclusions concerning the suitability of the applied methods.
Practical activities within the subject	Not applicable

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