



## Subject card

Subject name and code	Vacuum technique, PG_00053365						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2024/2025		
Education level	second-cycle studies		Subject group		Optional subject group 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		2.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Sebastian Bielski				
	Teachers		dr inż. Sebastian Bielski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		2.0		18.0	50
Subject objectives	Knowledge of the following concepts concerning modern vacuum technology:  • properties of gases • surface processes (adsorption and desorption) • creating a vacuum • measuring a vacuum • vacuum components, construction and leak detection						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	The student is able to run, test and use vacuum devices for experimental purposes.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[K7_K01] is ready to create and develop models of proper behaviour in the work and life environment; undertake initiatives; critically evaluate actions of their own, teams and organisations they are part of; lead a group and take responsibility for its actions; responsibly perform professional roles taking into account changing social needs, including: - developing the achievements of the profession, - observing and developing rules of professional ethics and acting to comply to these rules	Students plan and conduct experiments and prepare reports by working in groups.	[SK2] Assessment of progress of work
	[K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	The student gains knowledge about construction, operation and use of vacuum devices.	[SW1] Assessment of factual knowledge
Subject contents	1) The concept of vacuum in physics and technology 2) The properties of gases 3) The gas flow and surface phenomena 4) Vacuum preparation 5) Mechanical vacuum pumps 6) Jetvacuum pumps 7) Sorption pumps 8) Vacuum measurement 9) Leak Detection 10) Elements of vacuum systems		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratories, reports, oral presentations	100.0%	49.0%
	written test	50.0%	51.0%
Recommended reading	Basic literature	<ul style="list-style-type: none"><li>S. Bielski, materials published on the moodle platform <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30289">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30289</a></li><li>"Modern vacuum physics" Austin Chambers CRC Press 2004</li></ul>	
	Supplementary literature	Materials and data available on the websites: <ul style="list-style-type: none"><li><a href="https://www.leybold.com/content/dam/brands/leybold/web-only/download-center/brochures/general-brochures/Fundamentals_of_Vacuum_Technology_EN.pdf">https://www.leybold.com/content/dam/brands/leybold/web-only/download-center/brochures/general-brochures/Fundamentals_of_Vacuum_Technology_EN.pdf</a></li><li><a href="http://www.idealvac.com/files/manuals/Kinney_Piston_Vacuum_Pump_Brochure.pdf">http://www.idealvac.com/files/manuals/Kinney_Piston_Vacuum_Pump_Brochure.pdf</a></li><li><a href="https://www.agilent.com/cs/library/usermanuals/Public/6999-01-140C_Eng%20High%20Throughput%20Diffusion%20Pum">https://www.agilent.com/cs/library/usermanuals/Public/6999-01-140C_Eng%20High%20Throughput%20Diffusion%20Pum</a></li><li><a href="http://www.idealvac.com/files/literature/03_Edwards_2011_Vapour_Diffusion_Pumps.pdf">http://www.idealvac.com/files/literature/03_Edwards_2011_Vapour_Diffusion_Pumps.pdf</a></li><li><a href="http://www.idealvac.com/files/brochures/Pfeiffer-Adixen-Leak-Detectors-Brochure.pdf">http://www.idealvac.com/files/brochures/Pfeiffer-Adixen-Leak-Detectors-Brochure.pdf</a></li></ul>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"><li>Gas adsorption and its importance.</li><li>Physical basis of vacuum measurements.</li><li>Construction, operation and properties of a rotary pump.</li></ul>		
Work placement	Not applicable		