GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Vacuum technology, PG_00037288		
Field of study	Technical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	first-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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Atomic Physics and Luminescence -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Sebastian Bielski	
	Teachers		

Lesson types

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

The aim of the course is to provide knowledge of modern vacuum technology, with particular focus on the following topics:

- properties of gases
- surface processes (adsorption, desorption)
- vacuum generation
- vacuum measurement
- components of vacuum systems, construction, leak detection.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] has advanced knowledge of the principles of experimental design, experimental methods, measurement techniques and scientific equipment used in physics and related sciences, including their life cycle.	The student has knowledge of the vacuum equipment and the methodology of planning measurements under low-pressure conditions.	[SW1] Assessment of factual knowledge
[K6_U02] is able to analyse and solve complex and non-standard scientific and technical problems using appropriate analytical, computational, numerical, simulation or experimental methods.	The student is able to independently plan a start-up procedure for a vacuum system, perform its tests, and utilize it to conduct an experimental task.	[SU1] Assessment of task fulfilment
[K6_U04] is able, individually or in a team, to plan and conduct experiments in physics and related fields, including applied computer science or energy engineering, and to analyse and interpret results and formulate conclusions.	As part of a laboratory group, the student is able to conduct measurements in the field of vacuum technology, analyze and interpret the obtained results, and formulate conclusions regarding the system's operating parameters.	[SU1] Assessment of task fulfilment

Subject contents

Course content – lecture

Lecture

1) The concept of vacuum
2) Selected properties of gases
3) Absorption and adsorption of gases
4) Gas flow
5) Vacuum generation

- Mechanical vacuum pumps
- Jet vacuum pumps
- Sorption pumps

6) Vacuum measurement
7) Mass spectrometry
8) Leak Detection

Course content – laboratory

Laboratory

- Assembly of a vacuum system with a pump, valve, and measuring head.
- Disassembly and assembly of a rotary vane pump and a diffusion pump.
- Operation of a vacuum system with a turbomolecular pump and a wide-range gauge.
- Effective pumping speed; characteristics of a dosing valve.

Prerequisites and co-requisites

None

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture: final test (60 min.)	50.0%	50.0%
Laboratories: oral assessment	50.0%	50.0%
Laboratories: reports	100.0%	0.0%
Labvoratory: performance of 4 laboratory experiments	100.0%	0.0%

Recommended reading

Basic literature

S. Bielski, materials published on the moodle platform
"Modern vacuum physics" Austin Chambers CRC Press 2004

Fundamentals of leak detection, Leybold GmbH, 2024 https://www.leybold.com/content/dam/brands/leybold/downloads/gated/Fundamentals-of-leak-detection-2024.pdf

	Supplementary literature	Materials and data available on the websites https://www.leyboldproducts.com/media/pdf/87/a8/be/FVT_Fundamentals_of_Vacuum_Technology_EN58774555441f3.pdf http://www.idealvac.com/files/manuals/Kinney_Piston_Vacuum_Pump_Brochure.pdf https://www.agilent.com/cs/library/usermanuals/Public/6999-01-140C_Eng%20High%20Throughput%20Diffusion%20Pumps% http://www.idealvac.com/files/literature/03_Edwards_2011_Vapour_Diffusion_Pumps.pdf http://www.idealvac.com/files/brochures/Pfeiffer-Adixen-Leak-Detectors-Brochure.pdf
	eResources addresses	
Example issues/ example questions/ tasks being completed	**Lecture** Discuss the physical principles of operation of an ionization vacuum gauge. Discuss the construction, operating principle, and properties of a rotary pump. **Laboratory** Assemble a vacuum system with a pump, valve, and measuring head. Measure the effective pumping speed of the given system.	
Practical activites within the subject	Not applicable	

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