GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Low Temperature and Pressure Techniques, PG_00060351		
Field of study	Materials Engineering, Materials Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
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	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marek Augustyniak	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	15.0	0.0	0.0	15

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	15	2.0	8.0	25

Subject objectives

The course aims to equip students with practical skills related to vacuum and thermal insulation equipment. Strong emphasis is placed on independence and resourcefulness. A variety of techniques and tasks are offered, including assembling devices from relatively simple components, analytically and numerically predicting their parameters, critically evaluating the commercial product market, disassembling existing equipment and performing reverse engineering, as well as—optionally—3D printing selected parts.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] Knows selected aspects of construction and operation of scientific equipment in materials engineering.	The student employs materials and tools in order to construct and test his/her own devices.	[SW1] Assessment of factual knowledge
[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student is able to operate standard laboratory/workshop equipment and perform analyses related to materials testing.	[SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>Course content – laboratory
The course combines theory and practice, emphasizing hands-on skills and CAD/CAE. Its components include:

- approximate analytical calculations – (rough) estimation of the parameters of the devices to be assembled; e.g., assessing the ultimate strength of a vacuum pump made from a syringe

- CAD/CAE module: including pump impeller design and modeling the effects of vacuum and low temperature using ANSYS; for top students – a likely option to 3D print the designed parts

- "DIY" module:

a) vacuum pump built from syringes and valves (so far, an absolute pressure of around 0.05 bar has been achieved – can the next cohort improve on this result?)

b) vacuum flask; standard version: with "analog" temperature readout; for ambitious students: option to automate pressure and/or temperature sensors (Arduino)

- "reverse engineering" module: disassembly and CAD dimensioning of parts, e.g., from commercial vacuum pumps;</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></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>Assessment of project results</td><td>60.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Software documentation (included in installation files or downloaded from the web); instructional videos</td></tr>
<tr><td>Supplementary literature</td><td>Nie dotyczy.</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>- preliminary analytical calculations – (rough) estimation of the parameters of the equipment to be assembled; e.g., assessing the structural limits of a vacuum pump made from a syringe
- CAD/CAE module: including pump rotor design and modeling the effects of vacuum and low temperature using ANSYS; for top students—a potential option to 3D print the designed parts
- "DIY" module:
a) vacuum pump built from syringes and valves (so far, an absolute pressure of around 0.05 bar has been achieved—can the next cohort improve on this result?)
b) vacuum flask; standard version: with "analog" temperature readout; for ambitious students: option to automate pressure and/or temperature sensors (Arduino)
- "reverse engineering" module: disassembly and CAD dimensioning of parts, e.g., from commercial vacuum pumps;</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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