

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject High Vacuum and Low Temp. Techn.		Code 1010401261010410053
Field of study TECHNICAL PHYSICS	Profile of study (general academic, practical) general academic	Year /Semester 3 / 6
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 2 Classes: - Laboratory: 1 Project/seminars: -		No. of credits 5
Status of the course in the study program (Basic, major, other) basic		(university-wide, from another field) university-wide
Education areas and fields of science and art		ECTS distribution (number and %)
Responsible for subject / lecturer:		
dr inż. Wojciech Koczorowski email: wojciech.koczorowski@put.poznan.pl tel. +48 61 665 33 31 Faculty of Technical Physics ul. Piotrowo 3 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of physics, thermodynamics and chemistry, such as the definition of the gas, the types of gas particles, particle interaction, the concept of an ideal gas, real gas, gas conversion, the pressure
2	Skills	Performing technical drawings, including use software, analytical skills, using the Internet to acquire the necessary information
3	Social competencies	Ability to work in a group, active attitude to problem solving
Assumptions and objectives of the course:		
In terms of knowledge to provide students with the knowledge specified by the program, In terms of mastering the basics skills of high-vacuum generation techniques and methods for obtaining low temperatures, and the ability to design, operation and maintenance of vacuum measurement systems. In terms of social skills, teamwork skills.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Explain laws on the properties of gases under reduced pressure, and indicate the basic properties of cryogenic liquids and discuss the method of obtaining low temperatures - [[K_W12]] 2. Explain principles: pumps, meters and other equipment cryogenic vacuum, and connection standarts - [[K_W12, K_W13]] 3. Explain the principle of of construction of vacuum systems, including recognition and selecting of materials used in these techniques - [[K_W13]]		
Skills:		
1. 1. Use professional vocabulary and work with directories of companies producing components, vacuum properly describe the assembly of the components in the system connections - [K_U02, K_U03, K-U11]] 2. Self-designed systems for selected technological processes, applied correctly, instalation and support vacuum-cryogenic equipments - [[K_U03]] 3. Make simple diagnosis of selected devices, including Identify the typical flaws - [[K_U14]]		
Social competencies:		
1. 1. Express and substantiate a critical assessment on the specific design solutions based on acquired knowledge and skills - [[K-K03]]		
Assessment methods of study outcomes		

<p>Forming Score:</p> <p>a) In terms of the project: on the basis of (1) the current implementation of design tricks and (2) assess the preparation for classes</p> <p>b) In the lecture: on the basis of (1) answers to questions concerning the material discussed in the previous lectures</p> <p>Summary score :</p> <p>a) In terms of the project: on the basis of (1) the accuracy and the form of their project, (2) made ??a public presentation of the project, (3) discussions held both in their presentation and that of others</p> <p>b) In the lecture: on the basis of a written exam, answers to questions scored on a scale 0-1, driving test after obtaining at least 55% of the points from the written test and the correct answers in the oral test. The exam can be applied after completing the course design, (2) discuss the results of the examination.</p>	
<p>Course description</p>	
<p>-Lecture:</p> <p>Fundamentals of kinetic theory of gases and thermodynamics</p> <p>Terms of viscous and molecular</p> <p>Viscous effects, effusion, diffusion and thermal conductivity of gases under reduced pressure</p> <p>Description and mechanisms of gas flow</p> <p>The physical and chemical processes occurring on the surface of the solid under reduced pressure: sorption, desorption and adsorption</p> <p>Fundamentals of vacuum technology</p> <p>The materials used in the technology of low pressure, vacuum systems combine elements</p> <p>Vacuum system components and design principles and health in vacuum technology</p> <p>Methods of obtaining a vacuum and its control</p> <p>Distribution and operation of vacuum pumps</p> <p>Pump Selection Criteria</p> <p>Fundamentals of vacuum metrology</p> <p>Distribution and operation of vacuum gauges</p> <p>Mass Spectrometry</p> <p>Leaks in vacuum systems and detection</p> <p>Basics of cryogenics, the basic definitions</p> <p>Getting low-temperature gas liquefaction</p> <p>Liquid and gas properties of materials at low temperatures</p> <p>The use of vacuum technology and cryogenics</p> <p>Project:</p> <p>Identification of the various applications of vacuum.</p> <p>Analysis of the parameters available parts and components based on vacuum components catalogs.</p> <p>Schematic representation of vacuum</p> <p>Design of the vacuum system (in groups of two) conceptual design drawn by the students. The project is to design a system implementing individual design assumptions, including:</p> <ul style="list-style-type: none"> - Design of the vacuum chamber - Selection of the pumping system and the measuring - Selection of additional components such as windows, culverts <p>Presentation and discussion of completed projects</p>	
<p>Basic bibliography:</p>	
<p>Additional bibliography:</p>	
<p>Result of average student's workload</p>	
<p>Activity</p>	<p>Time (working hours)</p>

1. Wykład	30	
2. Projekt	15	
3. Konsultacje projektów	14	
4. Przygotowanie do projektu	30	
5. Przygotowanie do egzaminu	30	
6. Egzamin	4	
7. Omówienie wyników egzaminu	2	
Student's workload		
Source of workload	hours	ECTS
Total workload	125	5
Contact hours	65	3
Practical activities	45	1