STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
(-)		**1010401151010411258**
Field of study	Profile of study (general academic, practical)	Year /Semester
EDUCATION IN TECHNOLOGY AND	**practical**	**3 / 5**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**elective**
Cycle of study:	Form of study (full-time,part-time)	
First-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **2** Classes: **2** Laboratory: **-** Project/seminars: **-**		**5**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
other	**university-wide**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge on physics, thermodynamics and chemistry, such as the definition of gas, types of gas molecules, interactions of molecules, the concept of an ideal gas, real gas, conversion gas pressure
2	**Skills**	Making technical drawings, including support software, analytical skills, the use of the Internet to acquire the needed 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 lows on the properties of gas under reduced pressure, thermodynamics and discuss the basic methods for obtaining low temperatures - [K_W01 K_W09]

2. Explain principles: pumps, meters and other equipment próżniowo- cryogenic and ways of combining elements. - [K_W12]

3. Explain the principles of constructing vacuum systems, along with the recognition and pairing of materials used in these techniques. - [K_W19]

Skills:

1. Use specialist vocabulary and work with directories of companies producing vacuum components, properly describe the assembly of the components within the system connections - [K_U01 K_U03]

2. Independent design systems for selected processes used correctly, install and handle vaccum and cryogenic equipment - [U09 K_U10 K_U16 K_K_U24 K_U20]

3. Identify the typical symptoms of selected devices, along with elements of their diagnosis, and indicate their use - [K_U23]

Social competencies:

1. Express and justify a critical assessment on the specific design solutions based on acquired knowledge and skills. - [K_K01 K_K05]

2. Develop teamwork skills. - [K_K01 K_K05]

Assessment methods of study outcomes

Forming Score:

a) In terms of the project: on the basis of (1) the current implementation of design tricks and (2) assess the preparation for classes

b) In the lecture: on the basis of (1) answers to questions concerning the material discussed in the previous lectures

Summary score :

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

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.

Course description

-Lecture:

Fundamentals of kinetic theory of gases and thermodynamics

Terms of viscous and molecular

Viscous effects, effusion, diffusion and thermal conductivity of gases under reduced pressure

Description and mechanisms of gas flow

The physical and chemical processes occurring on the surface of the solid under reduced pressure: sorption, desorption and adsorption

Fundamentals of vacuum technology

The materials used in the technology of low pressure, vacuum systems combine elements

Vacuum system components and design principles and health in vacuum technology

Methods of obtaining a vacuum and its control

Distribution and operation of vacuum pumps

Pump Selection Criteria

Fundamentals of vacuum metrology

Distribution and operation of vacuum gauges

Mass Spectrometry

Leaks in vacuum systems and detection

Basics of cryogenics, the basic definitions

Getting low-temperature gas liquefaction

Liquid and gas properties of materials at low temperatures

The use of vacuum technology and cryogenics

Project:

Performing calculations in terms of thermodynamics, the properties of gas under vacuum conditions

Methods for measuring pressure, temperature, and determining pumping speed

Identification of the various applications of vacuum.

Analysis of the parameters available parts and components based on vacuum components catalogs.

Schematic representation of vacuum

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:

- Design of the vacuum chamber
- Selection of the pumping system and the measuring
- Selection of additional components such as windows, culverts

Presentation and discussion of completed projects

Basic bibliography:

1. 1. Katalogi i instrukcje obsługi producentów urządzeń próżniowych 2. Technologia wysokiej próżni, A. Hałas, PWN, Warszawa, 1980 3. Technika wysokiej próżni, J. Groszkowski, PWN, Warszawa, 1978 4. Technika doświadczalna w fizyce niskich temperatur, G. K. White, PWN, Warszawa, 1965 5. Vacuum Technology Know How dostępny na stronie: http://www.pfeiffer-vacuum.com/downloads/container, w formacie pdf

Additional bibliography:

1. 1. Urządzenia próżniowe, J. Groszkowski, WSiP, Warszawa, 1982 2. Experimental techniques in Low-Temperature Physics, G. K. White, P. J. Meeson, Clarendon Press, Oxford, 2002 3.Matter and Methods at Low Temperatures, F. Pobell, Springer, Berlin, 1996

Result of average student's workload

Activity		**Time (working hours)**
1. Total workload		160
2. Addressing requiring individual contact with your teacher		75
3. Practical Classes		45
Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	160	4
Contact hours	75	3
Practical activities	45	1