



Subject card

Subject name and code	Low temperature techniques in medicine, PG_00021166						
Field of study	Mechanical and Medical Engineering						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Waldemar Targański				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	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	5.0		15.0	50	
Subject objectives	Student independently solves difficult problems of heat flow, the throttling process and processes occurring in the humid air. Student formulates a physical description of the phenomena and technological points of their applications in cryotechnology and medicine.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_U05] He/she can use measurement technique and methods to assess errors of measurement. He/she can plan and conduct research (also numerical ones) and interprets obtained results and draw conclusions	Students are able to use measuring equipment and methods of estimating measurement errors, plan and conduct experiments (including computer simulations), critically interpret the results obtained and draw conclusions			[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		
	[K7_U04] He/she can use programming-communicative techniques concerning to the scope of engineering tasks	The student is able to use information and communication techniques appropriate to perform engineering tasks, including computer methods			[SU4] Assessment of ability to use methods and tools		
	[K7_W03] He/she knows methods, techniques and tools applied to solve engineering problems in the scope of the field of study of mechanical-medical engineering	The student knows the methods, techniques and tools used to solve engineering tasks in the field of mechanical-medical engineering			[SW1] Assessment of factual knowledge		
	[K7_W08] He/she broad knowledge related to understand social, economic, legal, ecological and other outer techniques conditions of engineering activities in mechanical-medical engineering	The student has the expanded knowledge necessary to understand the social, economic, legal, ecological and other non-technical determinants of engineering activities in mechanical-medical engineering			[SW1] Assessment of factual knowledge		
	[K7_U09] He/she has skills to work in industrial environment and is aware of work safety rules	The student is prepared to work in an industrial environment and knows the principles of work safety			[SU3] Assessment of ability to use knowledge gained from the subject		

Subject contents	Area of interest of low temperatures technology and its use in medicine. Physical and chemical properties of gases. Properties of structural materials at low temperatures. Decompression gas as a method of achieving low temperatures. Gas circuits: Joule, Ackeret - Keller, Philips (Stirling). The device cascading technique at low temperatures. Joule - Thomson; differential throttling effect. Definition of inversion curve . Construction and operation of liquifiers: Linde - Hampson, Linde, two-stage throttling. Claude, Heylandta, La Rouge'a, Kapica - construction, operation, compatibility with circuit Linde - Hampson. Gas pollutants and ways to remove them. Gas separation techniques. Thermoelectric devices in the technique at low temperatures. The magnetocaloric phenomenon. Tanks - how to isolate, the method for determining the level of liquefied gas. Safety equipment and systems for low temperature.		
Prerequisites and co-requisites	THERMODYNAMICS, PHYSICS, HEAT TRANSFER AND HEAT EXCHANGERS, REFRIGERATION		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
Recommended reading	Basic literature	1. B. Russel, Scott: Technika niskich temperatur. 2. M. Chorowski: KRIOGENIKA Podstawy i zastosowania. 3. S. Nieświatowski: Izolacja aparatów i zbiorników do niskich temperatur. 4. A. Wesołowski: Urządzenia chłodnicze i kriogeniczne oraz ich pomiary cieplne. 5. E. Bodio: Skraplarki i chłodziarki kriogeniczne. 6. K. Mendelssohn: Fizyka niskich temperatur. 7. K. Mendelssohn: Na drodze do zera bezwzględnego. 8. R.F. Barron: Cryogenic systems.	
	Supplementary literature	Papers in branch magazines	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Area of interest cryotechnology and its field of use. The expansion of gas as a method to achieve low temperatures. Gas circuits: Joule ACKERET - Keller, Philips (Stirling). The device cascade in the low temperature technique. The effect of Joule - Thomson, Differential effect of throttling. Definition curve inversion. Construction and operation liquefier: Linde - Hampson, Linde with a two-stage throttling. Claude, Heylandta, La Rouge'a, Kapitza - The construction, operation, comparison of circuit Linde - Hampson. Pollutant gases and how to fix them. Liquid gases separation techniques. Thermoelectric devices in the art low temperatures. Magnetocaloric effect (adiabatic demagnetization). Tanks - methods for isolating, how to determine the level of liquefied gas.		
Work placement	Not applicable		

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