



## Subject card

Subject name and code	, PG_00058887						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		4.0		
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	30.0	0.0	0.0	15.0	0.0	45
	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	45		0.0		0.0	45
Subject objectives	Deepening of acquaintance of question from physics and thermodynamics. Familiarization with specificity of domain and solutions applicable						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W11] possesses organized knowledge useful in understanding ex-technical conditioning connected with performing the profession of an engineer and taking it into consideration in engineering practice; possesses well-established knowledge within the range of intellectual property, management and organization of manufacturing processes, including the management and life-cycle of a product		The student has structured knowledge useful for understanding non-technical conditions related to the low temperature technique; He has well-established knowledge in the field of intellectual property, management and organization of manufacturing processes, including quality and life cycle management of cryotechnic equipment.		[SW1] Assessment of factual knowledge		
	[K7_U01] is able to acquire information from specialist literary sources and other sources regarding the construction and operation of machines and related disciplines in polish and in a foreign language, is able to conduct a self-learning process, is able to synthesize the information, form conclusions and justify opinions		The student is able to obtain information from professional literature and other sources in the field of construction and operation of cryotechnical equipment in Polish and foreign languages and to synthesize information.		[SU2] Assessment of ability to analyse information		
	[K7_W06] possesses organized, profound knowledge necessary for designing and optimization of complex technological processes, modelling and calculations using numerical methods, knows modern manufacturing methods and tools for designing manufacturing processes of machines, devices, their elements and components		The student has a structured in-depth knowledge necessary to design and optimize cryotechnical systems using numerical methods; He is familiar with modern manufacturing methods and tools for designing cryogenic systems and their components and subassemblies.		[SW1] Assessment of factual knowledge		

Subject contents	Area of interest kriotechniki and domains of its (her) utilization. Gas Rozprężanie as method of achievement of low temperature. Gas circulations joule, Ackeret - Kellera, philips ( ) Stirlinga. Cascade fix-up in technique of low temperature. Effect joule - Thomsona; differential effect dławienia. Definition of bandy inversion. Structure and principle of operation skraplarki Lindego - Hampsona, with (from) two-gradual Lindego dławieniem. Claude, Heylandta, la rouge, Kapicy - structure, operation, comparison with circulation Lindego - Hampsona. Contaminating of gas and manners of their deletions. Techniques of divisions gas skraplanych. Fix-ups in technique of low temperature termoelektryczne. Phenomenon ( ) magnetokaloryczne rozmagnesowanie adiabatyczne. Headers (tanks) - manner isolate, manners of definitions of levels (horizons) gas skroplonych. Basic specialistic endowment (outfit) zbiornikowców LNG and LPG.		
Prerequisites and co-requisites	Physics, thermodynamics, heat transfer.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	75.0%	50.0%
	Written assessment	75.0%	50.0%
Recommended reading	Basic literature	M. Chorowski: Kriogenika. Podstawy i zastosowania. Wydawnictwo I.P.P.U. MASTA. Gdańsk, 2007. B. Russel, Scott: Technika niskich temperatur. Praca zbiorowa: Poradnik chłodnictwa. B. Stefanowski: Technika bardzo niskich temperatur w zastosowaniu do skraplania gazów. S. Nieświątowski: Izolacja aparatów i zbiorników do niskich temperatur. K. Mendelssohn: Fizyka niskich temperatur. K. Mendelssohn: Na drodze do zera bezwzględnego. A. Wesolowski: Urządzenia chłodnicze i kriogeniczne oraz ich pomiary cieplne. E. Bodio: Skraplarki i chłodziarki kriogeniczne. J.K. Włodarski i inni: Bezpieczeństwo transportu gazów skroplonych na zbiornikowcach. R.F. Barron: Cryogenic systems.	
	Supplementary literature	Articles from journals.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	The area of interest of cryotechnics and the fields of its use.  Cascade systems in low-temperature technology.  Joule-Thomson effect.  Design and principle of operation of the selected liquifier.  Gas contaminants and how to remove them.  Tanks - methods of insulation, methods of determining the level of liquefied gases.  Basic specialist equipment for LNG and LPG carriers.		
Work placement	Not applicable		