



## Subject card

Subject name and code	Fundamentals of Thermodynamics, PG_00060531						
Field of study	Naval Architecture and Offshore Structures						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2023/2024		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study 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	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Damian Bocheński				
	Teachers		mgr inż. Dominik Kreft  dr inż. Piotr Bzura  dr inż. Patrycja Puzdrowska  dr hab. inż. Damian Bocheński				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	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	60		6.0		34.0	100
Subject objectives	acquaint with the basic concepts of classical thermodynamics, laws of thermodynamics, properties of thermodynamic substances, energy and exergy balances for thermodynamic systems, ideal cycles of thermal machines, and explain the importance of lecture subjects in engineering practice						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_K02] can work in a team, assuming various roles, can act in a rational and ethical way		The student, working in a team, solves tasks and conducts laboratory exercises in thermodynamics		[SK2] Assessment of progress of work [SK3] Assessment of ability to organize work		
	[K6_W03] has knowledge of hydromechanics, thermodynamics, machine design, ecology, materials science necessary to understand the principles of construction and operation of ocean engineering facilities and equipment		Student applies knowledge of thermodynamics to solve technical problems. Recognizes the basic concepts of the terminology used in thermodynamics. It describes the properties of thermodynamic systems using zero and first and second laws of thermodynamics. Shows the energy metabolism in the system work and entropic systems. Specifies balances: mass, energy and exergy. Presents the ideal gas law and describes the properties of the energy of combustion engines, gym, steam, refrigeration and heat pumps with respect to their theoretical circuits. Analyzes the properties of the energy produced steam and describe the properties of solids and liquid, which are essential in engineering practice.		[SW1] Assessment of factual knowledge		

Subject contents	LECTURE Introduction. Fundamentals of thermodynamics. The zeroth law of thermodynamics. The principle of conservation of amount of substances. The first law of thermodynamics. Energy balance. Equations of ideal, semi-ideal and real states. Entropy. Changes in ideal gases. The second law of thermodynamics. Theoretical cycles in internal combustion piston engines. Theoretical cycles in internal combustion turbine engines. Thermodynamics of solids and fluids. Thermodynamics of steams. Theoretical cycles in steam power plant. Theoretical cooling cycles and heat pumps.		
Prerequisites and co-requisites	Subject knowledge of Mathematics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	completion of exercises laboratory	100.0%	30.0%
	colloquium on exercises	60.0%	30.0%
	colloquium from the lecture	50.0%	40.0%
Recommended reading	Basic literature	Pudlik W.: Termodynamika. Wyd. PG, Gdańsk 1995. 2. Szargut J.: Termodynamika. PWN, Warszawa 1980. 3. Szargut J.: Termodynamika techniczna. PWN, Warszawa 1991. 4. Szargut J.: Termodynamika techniczna. PWN, Warszawa 1998. 5. Wiśniewski S.: Termodynamika techniczna. WNT, Warszawa 1980. 6. Wiśniewski S.: Termodynamika techniczna. WNT, Warszawa 1999. 7. Wiśniewski S., Wiśniewski T.S.: Wymiana ciepła. WNT, Warszawa 1994. 8. Pudlik W., Grudziński D., Cieśliński J., Jasiński, W.: Termodynamika zadania i przykłady obliczeniowe. Gdańsk 2008	
	Supplementary literature	Buchowski H, Ufnalski W.: Podstawy termodynamiki, WNT, Warszawa 1998. 2. Domański R., Jaworowski M., Redow M., Kołdyś J.: Wybrane zagadnienia z termodynamiki w ujęciu komputerowym. PWN, Warszawa 2000. 3. Staniszewski B.: Termodynamika. PWN, Warszawa 1982.	
	eResources addresses	Adresy na platformie eNauczanie: Podstawy termodynamiki, C, OiKM PiBJ, sem. 2, lato 2023/24 (PG_00060531)(PG_00060581) - Moodle ID: 36483 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36483">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36483</a> Podstawy termodynamiki, C, OiKM PiBJ, sem. 2, lato 2023/24 (PG_00060531)(PG_00060581) - Moodle ID: 36483 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36483">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36483</a> Podstawy termodynamiki, C, OiKM PiBJ, sem. 2, lato 2023/24 (PG_00060531)(PG_00060581) - Moodle ID: 36483 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36483">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36483</a>	
Example issues/ example questions/ tasks being completed	1.Present the First Law of Thermodynamics in descriptive and analytical terms, 2. Describe the entropy of solids and liquids, 3. Draw a simple Joule cycle diagram and show graphs of such a cycle in "T-s" and "i-s" systems, and determine the formula for its efficiency, 4. Prove that the work performed by a piston machine in isothermal transformations is not equal for the same piston displacement, 5. Draw a heat graph for water, excluding heat of its pushing, and mark on it the heat of liquidity, the heat of evaporation and the superheat, and provide relationships defining specific enthalpy of wet steam and the mentioned types of heat.		
Work placement	Not applicable		