GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Technical Thermodynamics 2, PG_00042058		
Field of study	Power Engineering, Power Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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	2	Language of instruction	English
Semester of study	4	ECTS credits	3.0
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	prof. dr hab. inż. Dariusz Mikielewicz	
	Teachers	prof. dr hab. inż. Dariusz Mikielewicz dr inż. Waldemar Targański dr hab. inż. Jacek Barański dr inż. Marcin Jewartowski dr inż. Stanisław Głuch dr hab. inż. Michał Klugmann	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	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	40.0	75

Subject objectives	Familiarisation with advanced topics of thermodynamics

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] is able to formulate and carry out energy balances in devices and energy systems, also perform an energy audit of a simple building object, is able to perform a preliminary profitability analysis of a planned energy investment	knows the characteristics of moist air and its processes, combustion reactions and its kinetics, knows the basic laws of heat transfer.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W02] has a basic knowledge of physics (including optics, electricity and magnetism), chemistry, technical thermodynamics, fluid mechanics and general mechanics needed to understand and describe the basic phenomena occurring in devices and systems, energy plants and transmission networks and their environment	knows the basics of combustion, moist air, heat transfer, and the Joule Thomson effect	[SW1] Assessment of factual knowledge
[K6_W15] knows and understands the basic quantities characteristic methods for thermodynamics, fluid mechanics and hydraulics, hydrology; knows the calculation methods and IT tools necessary to analyse the results of laboratory and field work	Passed the demonstration labs in the course and completed the reports on these exercises.	[SW3] Assessment of knowledge contained in written work and projects
[K6_U06] is able to use the basic knowledge on the operation of energy equipment in the field of thermal power plants, thermal and energy and heating systems, combustion engines, compressors and rotating machines to assess the technical condition of the system	is generally familiar with methods of determining the heat transfer surface area in exchangers	[SU4] Assessment of ability to use methods and tools

Subject contents

LECTURE: Gas mixtures and moist gases. Mollier diagram and the basic moist air processes. Maxwell"s thermodynamic equations. Elements of combustion thermodynamics. Fundamentals of refrigeration. Fundamentals of heat transfer.
LABORATORIES: Gas analysis. Determination of calorific value of solid fuels and gases. The energy balance of the water boiler and heat exchanger (recuperator). Testing of the refrigerating unit. Testing of the air conditioning central unit. Testing of the fan.

Prerequisites and co-requisites

Thermodynamics 1

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	56.0%	67.0%
laboratory	56.0%	33.0%

Recommended reading

Basic literature	1. M.J. Moran, H.N. Shapiro, D.D. Boettner, M.B. Bailey, Fundamentals of Engineering Thermodynamics 8th Ed., Wiley, 2014 2. Y. Cengel, M. Boles, Thermodynamics An Engineering Approach, 8th Edition, Wiley, 2014
Supplementary literature	Any textbook in thermodynamics
eResources addresses	Adresy na platformie eNauczanie: Technical Thermodynamics 2, W/L, ET, sem. 4, letni 24/25 - Moodle ID: 45188 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=45188

Example issues/ example questions/ tasks being completed	1. Present and discuss known mechanisms of heat transfer on the example of overall heat transfer through a multilayer wall separating two fluids with different temperatures. 2. Define the thermal resistance due to conduction, convection and overall heat transfer. 3. Discuss how to include the effect of fouling on overall thermal resistance. 4. Definition of logarithmic mean temperature difference and temperature distribution in the parallel and counter-current heat exchangers. 5. Define specific humidity and relative humidity. What is a difference? 6. What is saturation temperature? 7. Construct sample of psychrometric chart. What the lines represent? 8. Describe graphically on a psychrometric chart all changes in the properties of air 9. The dry-bulb and wet-bulb temperatures in a classroom are 24degC and 16 degC, respectively. Determine (at psychrometric chart) the humidity ratio, relative humidity and dew point at atmospheric pressure. 10. Construction of Psychrometric Chart 11. Design and operation of Linde-Hampson liquifier with representation of the process on a thermodynamic diagram. 12. Definition of inversion point and inversion curve. 13. What is the Joule-Thomson effect? The purpose and the coefficient of this effect. 14. Definition of combustion process 15. The stages of the solid fuel combustion 16. The main characteristics of the flames 17. Describe what is air excess number and how we can calculate it 18. What is the difference between adiabatic flame temperature and real flame temperature
Work placement	Not applicable

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