



Subject card

Subject name and code	Thermodynamics II, PG_00040185						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2022	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	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				
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	6.0		39.0	75	
Subject objectives	Familiarisation with advanced topics of thermodynamics						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U06		Knows the mechanisms of combustion, condensation, moisture migration, basics of heat exchangers		[SU3] Assessment of ability to use knowledge gained from the subject		
	K6_W09		Knows the mechanisms of combustion, condensation, moisture migration, basics of heat exchangers		[SW1] Assessment of factual knowledge		
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						

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> 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
<p>Work placement</p>	<p>Not applicable</p>