GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Thermodynamics, PG_00055881						
Field of study	Power Engineering						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2025/2026			
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	Polish			
Semester of study	3		ECTS credits	9.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jan Wajs				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	30.0	30.0	0.0	0.0	105
	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	105		9.0	111.0		225
Subject objectives	Student acquire basic knowledge of thermodynamics in the dimension of theory and practice.						

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	Student is able to write the energy balance of the device (e.g. piston engine, compressor heat pump, refrigerating unit).	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[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	Student defines basic concepts of thermodynamic, 1st and 2nd Law of Thermodynamic and state equations of gases. Student describes gas/steam cycles. Student uses the theory of moist gases and explains fundamentals of thermodynamic combustion.	[SW1] Assessment of factual knowledge
[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	Student possesses the knowledge needed to identify physical phenomena occurring during the operation of simple thermodynamic systems (open and closed). On this basis, he correctly describes the types of energy conversion or transformation occurring in them.	[SU2] Assessment of ability to analyse information
[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	Student uses graphs and tables of the physical properties to prepare laboratory reports. The student knows the methods of measuring thermal parameters. Student is able to interpret the results of measurements or calculations of energy balance for various machines.	[SW1] Assessment of factual knowledge

Subject contents

LECTURE: Basic concepts. The first law of thermodynamics. Ideal gas model. Properties of ideal, semi-ideal and real gases. Gas laws, thermal and caloric equation of state. Characteristic processes of ideal gas. Gas mixtures. Thermodynamic gas cycles. Entropy. The second law of thermodynamics and its consequences. Isobaric evaporation process. Properties of mono-component saturated steam. Properties of superheated steam. Characteristic processes of steam. Thermodynamic steam cycles. Gas mixtures and moist gases. Mollier diagram and the basic moist air processes. Fundamentals of refrigeration. Basics of compressor and sorption heat pumps. Elements of combustion thermodynamics.

EXERCISES: Simple conversion of energy, heat, work. The balances of power of open or closed thermodynamics systems. State and functions of state of ideal and semi-ideal gases and gas mixtures. Characteristic processes of gases. Gas thermodynamic cycles. Characteristic changes of steam. Calculations thermodynamic steam cycles.

LABORATORIES: Measurements of thermodynamic parameters: temperature and pressure. Determination of mass flow rate. Determination of air and water enthalpy. Energy balance of heat pump. Testing of the refrigerating unit. Determination of calorific value of solid and gas fuels. Energy balance of piston engine. Testing of the compressor.

Prerequisites and co-requisites

Knowledge from course of physics and mathematics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory reports	100.0%	20.0%
Middterm colloquiums	56.0%	30.0%
Written exam	56.0%	50.0%

Recommended reading

Basic literature

- Y. Cengel, M. Boles, Thermodynamics An Engineering Approach, 8th Edition, Wiley, 2014.
- M.J. Moran, H.N. Shapiro, D.D. Boettner, M.B. Bailey, Fundamentals of Engineering Thermodynamics 8th Ed., Wiley, 2014.
- R. Mayhew, Engineering thermodynamics/Work & Heat Transfer. Wiley & Sons Inc. 1993, USA.

	Supplementary literature	no requirements
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Present equations of first law of thermodynamics. Describe Carnot Cycle. Describe Rankine / Otto / Diesel / Brayton cycle. Methods of improving the efficiency of Clausius-Rankine cycle. Present definitions of second law of thermodynamics. Operational principle of compressor heat pumps. Heating and humidification of air. Energy balance of piston engine.	
Work placement	Not applicable	