University of Gdańsk

Subject card

Subject name and code	Thermodynamics, PG_00182146						
Field of study	Medical Physics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Bachelor's 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 polish		
Semester of study	3		ECTS credits		4.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Stanisław Pogorzelski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	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		0.0		60.0	120
Subject objectives	To familiarize students with the laws of physics in the field of thermodynamics, with particular emphasis on physical phenomena and technical problems encountered in the medical community. To present physics as a fundamental science for the entire group of natural sciences, including medicine, chemistry, and biology.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[FIZMEDL3_W01] Knows and understands at an advanced level the phenomena, principles, laws and theories specific to physics and biophysics.	The student possesses knowledge of the laws , principles and concepts of thermodynamics, as aweel as phenomenological and statistical approaches to describing phenomena within the scope of the subject. The student knows : principal thermodynamic concepts and quantities, the thermodynamic foundation of heat machines and heat balance principles; the assumptions and scopes of applicablity of basic theories: idela gas and real gas theory, kinetic theory of gases, description of phase transitions and phase diagrams, models of transport processes; and the fundamentals of thermodynamics of chemical and interfacial systems.	[SW4] test/exam - oral or written [SW3] text preparation/written work
[FIZMEDL3_U01] He can formulate, analyse, and solve complex problems in physics and medicine, using mathematical formalism, based on the physical phenomena, principles, and theories he has learned.	Students understands how to describe thermodynamic processes based on mathememetical formalism.They understand the applicability of physicochemical parameters. They appreciate simulations in studing the kinetics of process development and predicting thermodynamic states.	[SU3] text preparation/written work [SU4] test/exam - oral or written

Subject contents

1. Basic and introductory information: temperature and its measurement; the zeroth law of thermodynamics; elementary work and quasi-static processes.

2. Gaseous processes: the state of a thermodynamic system; the ideal and real gas models.

3. The First Law of Thermodynamics: experimental foundations and axiomatization of the First Law of Thermodynamics; internal energy; formulation of the First Law of Thermodynamics; consequences of the First Law of Thermodynamics: energy balances, isotherm and adiabat diagrams, specific heats, phase transitions.

4. The Second Law of Thermodynamics: experimental foundations and axiomatization of the Second Law of Thermodynamics; entropy; consequences of the Second Law of Thermodynamics: conditions for processes, equilibrium conditions, heat machines; thermodynamic potentials and relationships between thermodynamic functions.

5. Kinetic-molecular theory of an ideal gas: the principle of equipartition of energy; statistical thermodynamics and the application of probability distributions.

6. Thermodynamics of chemical systems: energetic effects of chemical reactions; chemical potential; equilibria in dilute solutions; thermodynamics of interfacial systems.

7. Transport processes: flux, conservation laws in transport processes, the continuity equation, the Third Law of Thermodynamics, direct and cross-flow processes; mass and energy transport: diffusion, convection; blackbody radiation.

8. The phenomenon and laws of surface adsorption, physical kinetics, Fick's laws.

9. Thermodynamics and kinetics of liquids and gases, including continuity, Bernoulli's laws, and Pascal's laws.

Prerequisites and co-requisites

A. Formal requirements: Students who have successfully completed first-year courses may attend the classes. Completion of previous courses in fundamentals of physics.

B. Prerequisites: Basic knowledge of mechanics and basic differential and integral calculus.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	activity during classes	0.0%	5.0%
	exam	51.0%	60.0%
	colloquia	51.0%	35.0%

Recommended reading	Basic literature	not A.1. wykorzystywana podczas zajęć: 1. D. Halliday, R. Resnick, J. Walker, Podstawy fizyki Tom II, Wyd. Naukowe PWN, Warszawa 2003. 2. A. Wróblewski, J. Zakrzewski, Wstęp do fizyki , PWN, Warszawa 1984. 3. B. Jaworski, A. Dietłaf, L. Miłkowska, G. Siergiejew, Kurs fizyki, Tom I, PWN Warszawa 1984. 4. K. Gumiński, "Termodynamika", PWN, 1972 5. J. Kalisz, M. Massalska, J. M. Massalski, Zbiór zadań z fizyki z rozwiązaniami, PWN, 1974. 6. A. Hennel, W. Szuszkiewicz, Zadania i problemy z fizyki, PWN, 1993. A.2. studiowana samodzielnie przez studenta: 1. J. Orear, Fizyka, Tom I, Wydawnictwo Naukowo-Techniczne, 1979. 2. R. Hołyst, A. Poniewierski, A. Ciach, Termodynamika dla chemików, fizyków i inżynierów, Wydawnictwo Uniwersy-tetu Kardynała Stefana Wyszyńskiego, 2005. 3. A. Hennel, W. Krzyżanowski, W. Szuszkiewicz, K. Wódkiewicz, Zadania i problemy z fizyki, PWN, 1974. 4. K. Jezierski, B. Kołdka, K. Sierański, Skrypt do ćwiczeń z fizyki dla studentów I roku Wyższych Uczelni, cz.2. Scripta,2000. 5. F. Reif, Fizyka Statystyczna, PWN, W-wa, 1973. 6. K. Zalewski, Wykłady z termodynamiki fenomenologicznej i statystycznej, PWN, W- wa, 1969. 7. A. Syrwid, Termodynamika, skrypt dla studentów Uniwersytetu Jagiellońskiego, Kraków, 2011. 8. M. Bełtowska- Brzezińska, Podstawy Termodynamiki Chemicznej, skrypt dla studentów Uniwersytetu Adama Mickiewicza, Poznań, 2009. 9. W. Salejda, Termodynamika z elementami termodynamiki statystycznej, notatki do wykładów z Fizyki dla studentów Politechniki Wrocławskiej, Wrocław, 2007.

		10. R. Hołyst, A. Poniewierski, A. Ciach, Termodynamika dla Chemików, Fizyków i Inżynierów, wykłady z Fizyki Instytut Chemii Fizycznej PAN, Warszawa, 2003.
	Supplementary literature	not 1. R.P. Feynman, R.B. Leighton, M. Sands, Feynmana wykłady z fizyki, Tom I cz.2, Tom II, PWN, 2011/2012 2. G. L. Squires, Praktyczna fizyka, PWN, 1992 3. Z. Kąkol, "Fizyka", skrypt dla studentów Uniwersytetu Jagiellońskiego, Kraków, 2011. 4. W. Salejda, "Termodynamika z elementami termodynamiki statystycznej", notatki do wykładów z Fizyki dla studentów Politechniki Wrocławskiej, Wrocław, 2007
	eResources addresses	
Example issues/ example questions/ tasks being completed	Thermodynamic processes, heat machines, thermodynamics of solutions and physicochemical reactions, thermodynamics of phase transitions, interactions in liquids, thermocapillary phenomena, environmental thermodynamics, thermodynamics of colloidal systems and soft matter. Radiation thermodynamics.	
Work placement	Not applicable	

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