



## Subject card

Subject name and code	Thermodynamics and statistical physics, PG_00037279						
Field of study	Technical Physics						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2022/2023		
Education level	first-cycle studies	Subject group			Optional subject group 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	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Piotr Weber				
	Teachers		dr Piotr Weber				
Lesson types and methods of instruction	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		5.0		35.0	100
Subject objectives	The aim of the lecture is: <ul style="list-style-type: none"><li>familiarize students with the basics of classical and quantum statistical physics</li><li>familiarize students with deductions explaining the properties of macroscopic bodies (thermodynamic properties) from the formalism of statistical physics</li><li>familiarize students with the elements of the theory of stochastic processes</li></ul>						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_W02		Student has an ordered knowledge of the fundamental laws of physics		[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation		
	K6_U02		Student can analyze standard problems in the field of statistical physics.		[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject		
Subject contents	The lecture consists of several topics in statistical physics and thermodynamics. There are presented the characteristics of macroscopic systems in terms of equilibrium phenomenological thermodynamics (for systems with fixed or variable number of particles). As part of this issue, the axioms of equilibrium phenomenological thermodynamics (principles of thermodynamics), Thermodynamic state functions are discussed. The lecture concerns the concept of state: in classical mechanics, quantum mechanics and statistical physics. In this part the student learns the concept of statistical state in the classical approach (for continuous and discrete systems) and quantum (the concept of density matrix is described). Equations of evolution of statistical states are discussed (master equation for discrete systems, Chapman-Kolmogorov equation, master equation for continuous systems, Fokker-Planck equation, von Neumann equation). The concept of entropy and its connections with information theory is presented. The idea of a statistical ensemble is presented: a microcanonical ensemble, a canonical ensemble and a great canonical ensemble. The lecture includes discussions on practical applications of statistical physics for: real gases (van der Waals equation, virial equation, Maxwell-Boltzmann distribution), quantum gases (quantum statistics) and phase transitions. The lecture also presents elements of the theory of random processes, (stochastic processes), generalized Langevine equation and the fluctuation-dissipation theorem.						

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Tutorials	50.0%	30.0%
	Lecture	50.0%	70.0%
Recommended reading	Basic literature	L. E. Reichl, "A Modern Course in Statistical Physics"  W. Greiner, L. Neise, H. Stöcker, "Thermodynamics and Statistical Mechanics"  F. Schwabl, "Statistical mechanics"	
	Supplementary literature	B. Ch. Eu, M. Al.-Ghoul "Chemical thermodynamics"  P. Atkins, J de Paula, J. Keeler, "Physical chemistry"	
	eResources addresses	Adresy na platformie eNauczanie: Termodynamika i fizyka Statystyczna - 2023 - Moodle ID: 29437 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29437">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29437</a> Termodynamika i fizyka Statystyczna - 2023 - Moodle ID: 29437 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29437">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29437</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		