Level: bachelor

Course title: Thermodynamics

Status: obligatory

ECTS: 8

Requirements: none

Learning objectives

Introduction and description of the thermal properties of matter, the concepts of temperature and heat for gaseous systems with many molecules, and basic laws of thermodynamics and statistical physics.

Learning outcomes

After completing the course, students should develop:

General abilities: student is trained to correctly perform experimental exercises and treat the data obtained as their results, as well as to solve numerical problems.

Specific abilities: successful student should master knowledge about the basic concepts of thermodynamics, temperature and heat, mechanisms of transfer of heat and work and heat engines, concept of entropy, many particle systems and the difference between ideal and real gasses. This knowledge should be the basis for understanding higher courses of physics, energetics and condensed matter physics.

Syllabus

Theoretical instruction

The concept of thermodynamics. Temperature. »Zero« law of thermodynamics. Temperature measurement. Heat. Heat capacity. Specific heat. Calorimetry. Influence of heat to substance – aggregate states, state diagram. Heat transfer. Conduction, convection and radiation. Heat of transformation. Work in thermodynamics. First law of thermodynamics. Internal energy of gasses. Joule - Thomson experiment. Enthalpy. Processes in gasses. Adiabatic and polytrophic process.

The fundaments of kinetic theory of gasses. Brownian motion. Equation of state of ideal gasses. Molecular mean free path. Maxwell's velocity distribution. Energy equipartition over degrees of freedom. Classical theory of heat capacities. Transport processes. Gas diffusion. Viscosity of gasses. Heat conduction.

Ideal heat engines. Carnot cycle. II law of thermodynamics. Clausius theorem. Entropy. Entropy changes in reversible and irreversible processes. Entropy and probability. Macrostates and microstates. Thermodynamic probability and entropy.

Thermodynamic potentials: free energy and free enthalpy. Maxwell's equations.

Principle of inaccessibility of absolute zero. Nernst theorem. The properties of matter in the vicinity of absolute zero.

Practical instruction

Selected experimental exercises in Heat and Thermodynamics. Measuring the temperature using thermocouple. The determination of the average temperature of a metal rod. Constant flow calorimeter. The verification of gas laws: Boyle-Mariotte and Gay-Lussac law. Determination of the ratio C_p/ C_v. Air moisture. Specific heat of solid bodies. The determination of the conductivity coefficient of the metal rod.

Problem solving sessions in all fields of Thermodynamics.

Weekly teaching load				Other:
Lectures: 3	Exercises: 1	Other forms of teaching: 2	Student research:	