Study programme(s): Mathematics M3, M4

Level: bachelor

Course title: Thermodynamics

Lecturer: Sonja Skuban

Status: elective, obligatory in module Technomathematics M3

ECTS: 7

Requirements: none

Learning objectives

The goal of the course is to introduce and describe the thermal properties of matter, the concept of temperature and heat of gaseous systems of molecules and the basic laws of thermodynamics and statistical physics.

Learning outcomes

After completion of the course content the student should have developed:
- Basic skills: Proper performing of experimental exercises and analysis of results. Solving arithmetic problems.
- Subject-specific skills: Acquiring knowledge about the basic concepts of thermodynamics, temperature and heat, the mechanism of heat and heat machines, the concept of entropy, a system of large number of particles, and the difference between the ideal and real gases. Adopted curriculum should be the basis for understanding the higher courses in physics, energy and condensed matter physics.

Syllabus

Theoretical instruction

Zeroth law of thermodynamics. Temperature measurment. Heat and heat capacity. Specific heat. Calorimetry. State diagrams. Conduction, convection and radiation. Ideal gas law. Real gases. The Van der Waals equation. Critical parameters. Real isotherms. First law of thermodynamics. Work and internal energy. Joulle and Joulle – Thomson experiment.Entalpy. Gas processes. Adiabatic and polytropic processes. Kinetic theory of gases. Maxwell – Boltzman distribution.Classical theory of heat capacities. Carnot cycle.Second law of thermodynamics.Clausius theorem.Entropy. Entropy and probability. Macrostates and microstates. Thermodynamics probability and entropy. Thermodynamic potentials. Born mnemonical rule. Maxwell relation. Nernst theorem.

Practical instruction

Experiments.Measure of temperature with thermometer. Measure of average temperature. Calorimeter of constant flux.Check of gas laws. Measure Cp/Cv.Humidity. Measure specific heat of solids. Determination coefficient of hear conduction. Computational exercises

Literature

1. F.V.Sirs: Uvod u termodinamiku, kinetičku teoriju plinova i statističku mehaniku, Vuk Karadžić, Beograd 1953.
2. Božidar Žižić: Tečaj opće fizike, molekularna fizika, termodinamika, mehanički valovi, IRO Građevinska knjiga, Beograd 1988.
3. A.Kapor, D.Nikolić: Eksperimentalne vježbe iz fizike, Mehanika i termodinamika, Univ. u Novom Sadu 0,2000
4. Á. Kapor, R. Kobilarov: Termodinamika i molekulska fizika, kroz računske probleme, Stilos 0,1995
5. Ágnes Kapor, Sonja Skuban: Praktikum demonstracionih vježbi iz fizike, II dio, PMF, Novi Sad 2000.

Weekly teaching load				Other: 0
Lectures: 3	Exercises 3	Other forms of teaching: 0	Student research: 0	

Lectures, laboratory exercises, computational exercises and workshops.
Lectures (3 hours per week during the semester), exercises (1 hour per week during the semester), labs (2 hour per week during the semester).

Grading method (maximal number of points 100)

Pre-exam obligations	**points**	**Final exam**	**points**
Activity during lectures	5	Written exam	20
Practical lessons	15	Oral exam	50
colloquia	10		