BACHELOR'S PROGRAMME
2nd YEAR OF STUDY, 1st SEMESTER

COURSE TITLE	CLASSICAL MECHANICS
COURSE CODE	
COURSE TYPE	full attendance
COURSE LEVEL	1st cycle (bachelor's degree)
YEAR OF STUDY, SEMESTER	2nd year of study, 1st semester
NUMBER OF ECTS CREDITS	6
NUMBER OF HOURS PER WEEK	7 (3 lecture hours + 4 seminar/laboratory hours)
NAME OF LECTURE HOLDER	Assoc. prof. dr. Cristian-Ioan BABAN
NAME OF LABORATORY HOLDER	Asist. dr. Alexandru LUKACS
PREREQUISITES	Advanced level of English

A — PROFESSIONAL AND TRANSVERSAL COMPETENCES

Professional competences:

- Identifying basic concepts of thermodynamics.
- Explaining the structure and operation of the components of different types of equipment using specific theories and tools (diagrams, mathematical and physical models, etc.).
- Description of the modeling methods of physical phenomena using notions and theories specific to physical and mathematical modeling.
- Explaining and interpreting physical phenomena and operationalizing key concepts based on the appropriate use of laboratory equipment.
- Critical evaluation of the results of the experiment, including the degree of uncertainty of the obtained experimental results.

Transversal competences:

- Identifying roles and responsibilities in a team and applying effective communication and work techniques within the team.
- Effective utilization of learning and communication resources and techniques for your own development.

B — LEARNING OUTCOMES

Upon successful completion of this discipline, students will be able to:

- explain the main thermal phenomena based on simple models;
- describes thermal phenomena from a thermodynamic and kinetic-molecular point of view;
- use theoretical notions to design and carry out laboratory experiments;
- analyze the results obtained;
- calculate the thermal parameters in certain given conditions.

C — LECTURE CONTENT

Introductory notions to thermodynamics (The object of thermodynamics. Thermodynamic system. State parameters. Process). The zeroth law of thermodynamics. Temperature.
Ideal gas laws. Equations of state. Temperature measurement.
Work. Heat and calorimetry. Heat exchange (conduction, convection, radiation). Caloric coefficients.
The first law of thermodynamics. Applications of the first principle of thermodynamics to the ideal gas (adiabatic process; Robert Mayer equation; polytropic process).
The second law of thermodynamics. Carnot cycle. The efficiency of the Carnot cycle. Thermal machines. Carnot's theorem.
Entropy. The fundamental equation of thermodynamics. Reversible and irreversible processes. The third law of thermodynamics. Consequences.
Thermodynamic potentials. Internal energy. Enthalpy. Free energy. Gibbs function. Maxwell's relations. Gibbs-Helmholtz equations.
Kinetic molecular theory of gases (molecular interactions, thermal motion, ideal gas model, kinetic molecular interpretation of pressure and temperature). Simple kinetic molecular theory of specific heats.
Basics of statistical physics. Entropy (Boltzmann's formula). Boltzmann distribution. Maxwell distribution.
Molecular collisions. Mean free path. Transport phenomena in gases
Real gases. The Wan der Waals equation. Low temperature physics
Liquid state. General characteristics. Internal pressure. Surface tension. Capillarity. Contact and surface phenomena.
Solid state. General properties (specific heat, linear expansion, thermal conductivity).
Phase transformations. Thermodynamic potentials in the case of open systems. Chemical potential. The Gibbs-Duhem equation. First order phase transitions. The Clapeyron-Clausius equation.
Solid-liquid phase transformation. Liquid-vapor phase transformation. Solid-vapor phase transformation. The triple point.

D — RECOMMENDED READING FOR LECTURES

1. A. M Steane, Thermodynamics - a complete undergraduate course, Oxford University Press. (2016)
2. D. Kondepudi, I. Prigoggine, Modern Thermodynamics from Heat Engines to Dissipative Structures (2nd ed), Wiley

	(2015) 3. M. W. Zemansky, R. H. Dittman, Heat and thermodynamics, McGraw- Hill (1997) 4. I. E. Irodov, Problems in General Physics, Arihant Publications (2020) 5. http://www.freebookcentre.net/Physics/ThermoDynamics-Books.html
E	**LABORATORY/SEMINARS CONTENT**
	Introductory notions to thermodynamics (The object of thermodynamics. Thermodynamic system. State parameters. Process). The zeroth law of thermodynamics. Temperature. Ideal gas laws. Equations of state. Temperature measurement. Work. Heat and calorimetry. Heat exchange (conduction, convection, radiation). Caloric coefficients. The first law of thermodynamics. Applications of the first principle of thermodynamics to the ideal gas (adiabatic process; Robert Mayer equation; polytropic process). The second law of thermodynamics. Carnot cycle. The efficiency of the Carnot cycle. Thermal machines. Carnot's theorem. Entropy. The fundamental equation of thermodynamics. Reversible and irreversible processes. The third law of thermodynamics. Consequences. Thermodynamic potentials. Internal energy. Enthalpy. Free energy. Gibbs function. Maxwell's relations. Gibbs-Helmholtz equations. Kinetic molecular theory of gases (molecular interactions, thermal motion, ideal gas model, kinetic molecular interpretation of pressure and temperature). Simple kinetic molecular theory of specific heats. Basics of statistical physics. Entropy (Boltzmann's formula). Boltzmann distribution. Maxwell distribution. Molecular collisions. Mean free path. Transport phenomena in gases Real gases. The Wan der Waals equation. Low temperature physics Liquid state. General characteristics. Internal pressure. Surface tension. Capillarity. Contact and surface phenomena. Solid state. General properties (specific heat, linear expansion, thermal conductivity). Phase transformations. Thermodynamic potentials in the case of open systems. Chemical potential. The Gibbs-Duhem equation. First order phase transitions. The Clapeyron-Clausius equation. Solid-liquid phase transformation. Liquid-vapor phase transformation. Solid-vapor phase transformation. The triple point.
F	**RECOMMENDED READING FOR LABORATORY/SEMINARS**
	1. A. M Steane, Thermodynamics - a complete undergraduate course, Oxford University Press. (2016) 2. D. Kondepudi, I. Prigoggine, Modern Thermodynamics from Heat Engines to Dissipative Structures (2nd ed), Wiley (2015) 3. M. W. Zemansky, R. H. Dittman, Heat and thermodynamics, McGraw- Hill (1997) 4. I. E. Irodov, Problems in General Physics, Arihant Publications (2020) 5. http://www.freebookcentre.net/Physics/ThermoDynamics-Books.html
G	**EDUCATION STYLE**
LEARNING AND TEACHING METHODS	Lecture, guided discovery, debate, problem solving
ASSESSMENT METHODS	• Lab activities (including reports) (30%), • Homework (20%) • Final Exam: multiple choice test (10%), written exam (20 %), oral exam (20%)
LANGUAGE OF INSTRUCTION	English