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

COURSE TITLE	MOLECULAR PHYSICS AND HEAT
COURSE CODE	
COURSE TYPE	full attendance
COURSE LEVEL	1st cycle (bachelor's degree)
YEAR OF STUDY, SEMESTER	1st year of study, 1st semester
NUMBER OF ECTS CREDITS	6
NUMBER OF HOURS PER WEEK	7 (3 lecture hours + 4 seminar hours)
NAME OF LECTURE HOLDER	Assoc. Prof. PhD Cristian-Ioan Baban
NAME OF SEMINAR HOLDER	Lect. PhD Laura Velicu
PREREQUISITES	Advanced level of English

A GENERAL AND COURSE-SPECIFIC COMPETENCES

General competences:

- → Effective use of information sources and communication resources and assisted professional training, both in Romanian and in a foreign language.
- → Elaboration, drafting and presentation in Romanian and/ or in a language of international circulation of a specialty work on a current topic in the field.

Course-specific competences:

- → Derivation of working formulas for calculations with physical quantities using appropriate principles and laws of Physics.
- → Description of physical systems, using specific theories and tools (experimental and theoretical models, algorithms, schemes, etc.)
- → Application of the principles and laws of Physics in solving theoretical or practical problems, under qualified assistance conditions.
- → Elaboration of graphs and reports for explaining and interpreting physical results obtained by statistical methods.
- → Correlation of statistical analysis methods on a given topic (realization of measurements /calculations, data processing, interpretation).
- → Assessing the reliability of the results and comparing them with bibliographical data or calculated theoretical values, using statistical validation methods and/ or numerical methods.
- → Application of Physics knowledge both in given situations in related fields and in experiments, using standard laboratory equipment.
- → Identification of Physics and Informatics methods, techniques and tools; Design of Physics experiments using specific laboratory methods and equipment.

B LEARNING OUTCOMES

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

- → Explain the main thermal phenomena based on simple models
- → Describe the thermal phenomena from thermodinamics and kinetic-molecular perspective.
- → Use theoretical notions to design and perform laboratory experiments
- → Analyze the results obtained from experiments
- → Calculate the thermal parameters under certain given conditions

C LECTURE CONTENT

Introduction to thermodynamics. Zeroth Principle of Thermodynamics; Temperature.
Temperature measurement. State equations;
Work. Heat and calorimetry. Caloric coefficients;
The first principle of thermodynamics. Applications of the first principle of thermodynamics to the ideal gas;
The second principle of thermodynamics. The Carnot Cycle. Carnot's theorem. Thermal machines.;
Entropy. Fundamental equation of thermodynamics. Reversible and irreversible processes. The Third Principle of Thermodynamics. Consequences;
Thermodynamic potentials. Maxwell's relations. Gibbs-Helmholtz equations;
Kinetic-molecular theory of gases (thermal motion, ideal gas model, kinetic-molecular interpretation of pressure and temperature); Elements of kinetic theory of specific heat;
Boltzmann's distribution. Maxwell's distribution.
Molecular collisions, Mean free path. Transport phenomena in gases.
Molecular interactions. Real Gases. Van der Waals equation. Low temperature physics;
Liquid state. General characteristics. Internal pressure. Surface tension, capillarity. Contact and surface phenomena Solid state.;
Phase transitions. Thermodynamic potentials for open systems. Chemical potential. Gibbs-Duhem equation. First order phase transitions. Clapeyron-Clausius equation ;
Solid-liquid phase transformation. liquid-gas, solid-gas phase transformation. The triple point.

D	RECOMMENDED READING FOR LECTURES
	1. M. Zemansky, R. Dittman, Heat and thermodynamics, McGraw-Hill 1997 2. S. Blundell, K. Blundell, Concepts in Thermal Physics, Oxford University Press, 2006 3. Violeta Georgescu, M. Sorohan, Fizică moleculară, Editura Univ. „Al. I. Cuza", Iaşi, 1996. 4. D. Haliday, R. Resnick, Fizică vol. I, Editura Didactică şi Pedagogică, Bucureşti, 1973. Referinţe suplimentare: 5. C. Baban, Fizică generală vol. I Mecanică şi termodinamică, Editura Stef Iaşi, 2007 6. F. Reif, Cursul de Fizică Berkeley, vol. V, Fizică statistică, Ed. Didactică şi Pedagogică, Bucureşti, 1983 7. F. Reif, Statistical Physics: Berkeley Physics Course, Vol. 5, Mcgraw-Hill; 1st ed. 2008 8. A. Kikoine, I. Kikoine, Molecular physics, Central Books Ltd 1979 9. A. Kikoine, I. Kikoine, Physique moléculaire, Editions Mir, Moscou, 1976.
E	SEMINAR CONTENT
	Applications to notions taught at the course Laborator Presentation of the laboratory; Labor protection; Measurement errors. Temperature measurement: Gas thermometer and thermocouple Temperature measurement: Resistance thermometer and thermistor Determination of specific heat of solids Determination of specific heat of liquids Determination of adiabatic index of gases Study of ideal gas laws Thermal machines. Reversible Stirling cycle Study of thermal expansion of solids Study of transport phenomena in gases. Determination of the viscosity coefficient. Determination of surface tension of liquids Determination of latent heat of vaporization and crystallization Restoring some activities. Recap. Laboratory colloquium
F	RECOMMENDED READING FOR SEMINARS
	1. G. I. Rusu, Mihaela Rusu, M. Sorohan, Fizică moleculară şi căldură, lucrări practice, vol I şi II, Univ. „Al. I. Cuza", Iaşi, 1986; 2. Laboratory manual 3. I. E Irodov, Problems in General Physics, Mir Moscow, 1988
G	EDUCATION STYLE
LEARNING AND TEACHING METHODS	Lecture, didactic explanation, heuristic conversation, video projection, problem solving method, case studies
ASSESSMENT METHODS	• Tests, written and oral examination • Weekly evaluation of homeworks and laboratory activity, colloquium
LANGUAGE OF INSTRUCTION	English