Stampare su carta intestata del CdS

General information		
Academic subject	ISTITUZIONI DI FISICA TEORICA II (Modulo B: Fisica Statistica)	
Degree course	Fisica	
Academic Year	III	
European Credit Transfer and Accumulation System (ECTS)		5
Language	Italian	
Academic calendar (starting and ending date)	September-December 2021	
Attendance	Free willing	

Professor/ Lecturer	
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Department and address	Dipartimento Interateneo di Fisica, Via Amendola 173
Virtual headquarters	
Tutoring (time and day)	On request. In presence or online

Syllabus	
Learning Objectives	Knowledge of mathematical and physical foundation of elementary statistical physics
Course prerequisites	Basics of thermodynamics and of elementary quantum mechanics
Contents	I. General principles of classical thermodynamics 1. *The problems and the postulates.* The temporal nature of Macroscopic Measurements. The Internal Energy. Thermodynamic Equilibrium. The Entropy Maximum Postulates. Mechanical and Chemical Equilibrium. 2. *Some formal relashionships.* The Euler Equation. The Gibbs-Duhem Relation. Summary of Formal Structure. The simple ideal gas. Molar Heat Capacity and Other Derivatives. 3. *Alternative Formulations and Legendre Transformations.* The Energy Minimum Principle. Legendre Transformations. Thermodynamics potentials. 4. *The Extremum Principle in the Legendre Transformed Representation.* The Minimum Principles for the Potentials. The Helmholtz Potential. The Enthalpy. The Gibbs Potential. 5. *Maxwell Relations.* The Maxwell Relations. A Thermodynamic Mnemonic Diagram. Some Simple Applications. Jacobian Transformations.

	II. Kinetic Theory 1. *The problem of kinetic Theory.* Formulation of the Problem. Binary Collisions. The Boltzmann transport equation. The Gibbsian ensemble. The BBGKY Hierarchy. 2. *The Equilibrium State of a Dilute Gas.* Boltzmann's H Theorem. The Maxwell-Boltzmann distribution. The Method of Most Probable Distribution. Analysis of the H Theorem. The Poincare' Cycle. III. Quantum Statistics. *1. Gas distributions.* Group distributions. Identical particles: bosons and fermions. Counting gas microstates. The three distributions. Specific heat for diatomic molecules. *2. Fermi-Dirac gas.* Properties of an ideal Fermi-Dirac gas. Applications to metals. *3. Bose-Einstein gas.* Properties of a Bose-Einstein gas. Gas of photons. Gas of phonons.
Books and bibliography	1. H. Callen, *"Thermodynamics and an Introduction to Thermostatics,"* John Wiley & Sons. 2. K. Huang, *"Meccanica Statistica,"* Zanichelli. 3. M. Alonso and E. Finn, *"Fundamental University Physics: Quantum and Statistical Physics,"* Addison-Wesley Publishing. 4. M. Falcioni e A. Vulpiani, *"Meccanica Statistica Elementare,"* Springer. 5. T. Guenault *"Statistical Physics,"* Springer
Additional materials	Only some chapters and some sections

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
150	32	15	103
ECTS			

Teaching strategy	
	Lectures/exercise classes in the classroom
Expected learning outcomes	
Knowledge and understanding on:	○ Comprehension of the theoretical formulation of Thermodynamics and Statistical Physics.
Applying knowledge and understanding on:	○ The students will acquire the ability to apply the principles of Thermodynamics and Statistical Physics to calculate relevant physical quantities in different phenomenological situations. They will acquire the ability to solve simple problems applying the principles of Statistical Physics and Thermodynamic.
Soft skills	• *Making informed judgments and choices* ○ Relation between experimental and theoretical physics. Use of the analogy in the development of the scientific knowledge • *Communicating knowledge and understanding* ○ Development of adequate skill in communicating the learnt topics • *Capacities to continue learning* ○ Ability is searching bibliographical references, in using (online) databases, and online material

Assessment and feedback	
Methods of assessment	Written exams on exercises treated during the lectures.
Evaluation criteria	• *Knowledge and understanding* ○ Knowledge of theoretical foundation of statistical physics • *Applying knowledge and understanding* ○ Use the acquired knowledge to solve problems of elementary statistical physics • *Autonomy of judgment* ○ Developing physical and mathematical tools to properly model physical problems relative to simple statistical physics • *Communicating knowledge and understanding* ○ Express in a proper way physical and mathematical concepts characterizing elementary statistical physics • *Communication skills* ○ Acquire an appropriate rigorous language to communicate science • *Capacities to continue learning*

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	○ Develop mathematical and physical tool to model physical problems
Criteria for assessment and attribution of the final mark	Accuracy in the solution of the written problems. Clarity in the exposition of the physical concepts.
Additional information	