COURSE OF STUDY *PHYSICS (L-30)*

ACADEMIC YEAR *2023-24*

TITLE OF THE COURSE *GENERAL PHYSICS I mod B: Fluids and Thermodynamics*

General information	
Year of the course	First
Academic calendar (starting and ending date)	II semester
Credits (CFU/ETCS):	7
SSD	FIS/01 Fisica Sperimentale delle Interazioni Fondamentali
Language	Italian
Mode of attendance	Optional

Professor/ Lecturer	
Name and Surname	Domenico DI BARI
E-mail	domenico.dibari@uniba.it
Telephone	080-5443151
Department and address	Dipartimento Interateneo di Fisica
Virtual room	MS TEAMS
Office Hours (and modalities: e.g., by appointment, on line, etc.)	TUE and THU 10-12 It is preferable to contact the professor for an appointment

Organizzazione della didattica			
Ore			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
70	40	30	*105*
CFU/ETCS			
7	5	2	

Learning Objectives	The course aims to acquire basic knowledge of the classical physics of oscillatory and wave mechanical motions, fluids, and Thermodynamics
Course prerequisites	Differential and integral calculus. Study of a function. Body Mechanics

Metodi didattici	Lectures and exercises

Expected learning outcom **Knowledge and understanding on:**	- ***Dublin descriptor***: *knowledge and understanding* Acquisition of the theoretical and experimental bases of Classical Physics and critical understanding of its most important aspects, in particular oscillatory and wave mechanical motions, fluids, and Thermodynamics. The development of this knowledge contributes to basic and characterizing training activities in the field of General Physics. The verification of this knowledge takes place through oral exams Understanding how the laws of Physics are verified through famous examples and experiments Understanding of the scientific method, nature and methods of research in Physics. This understanding is acquired by placing particular emphasis on the experimental nature of the discipline, modeling and the processes of construction of physical theories

Applying knowledge and understanding on:	***- Dublin Descriptor****: Ability to apply knowledge and understanding* Ability to set up and solve problems related to Classical Physics (of oscillatory and wave mechanical motions, fluids and Thermodynamics) Ability to identify essential elements of a phenomenon, in terms of order of magnitude and level of approximation needed ***Dublin Descriptor -*** *Making judgements* *At the end of the course, the student must be able to* Development of a correct critical sense to discern the significant aspects from the marginal ones, to evaluate the causes and effects, the correctness of the assumptions and approximations adopted Development of analytical skills aimed at identifying inconsistencies and possible sources of error Ability to recognize the variety and fascination of discoveries and theories of Physics Ability to evaluate the logical structure in the presentation (formal or informal, written or oral) of physics topics. This ability, as it is first and foremost self-assessment skills, is required in the various tests that the student must pass. It is also exercised with regard to the teacher in the phases of course evaluation - ***Dublin Descriptor*** *: ability to communicate what has been learned* Acquisition of competence in communication in Italian, in the oral and written tests
Soft skills	- ***Dublin descriptor****: ability to continue studying independently throughout life* The development of a correct critical sense to discern the significant aspects from the marginal ones, to evaluate the causes and effects, the correctness of the assumptions and approximations adopted Development of analytical skills aimed at identifying inconsistencies and possible sources of error Ability to recognize the variety and fascination of discoveries and theories of Physics Ability to evaluate the logical structure in the presentation (formal or informal, written or oral) of physics topics. This ability, as it is first and foremost self-assessment skills, is required in the various tests that the student must pass. It is also exercised with regard to the teacher in the phases of course evaluation
Syllabus	
Content knowledge	Oscillations Simple harmonic motion. Solution of the differential equation. Energy of the harmonic oscillator. Composition of harmonic motions on the same axis: same frequency; different frequency. Composition of harmonic motions on orthogonal axes. Damped harmonic motion: strong, critical, weak damping. Solution of the differential equation. Forced harmonic oscillator. Resonance. Hints. Waves Undulating motions. Mechanical waves in elastic media. Transverse and longitudinal waves. One-dimensional, two-dimensional and three-dimensional. Wavefront. Ray. Propagation of a wave. Sine waves. Wavenumber and angular frequency. Phase. Differential equation of the wave (vibrating string). The power and intensity of a wave. Phase and group speeds. Principle of superposition. Standing waves. Fluids Solids, liquids, gases. Pressure. Density. Fluid statics. Stevin's Law. Pascal's

	principle. Hydraulic press. Principle of communicating vessels. Archimedes' principle. Pressure measurements. Open tube pressure gauge. Surface phenomena. Surface tension. Cohesion, adhesion, capillarity. Fluid dynamics. Lagrange's and Euler's points of view. Characteristics of fluid motion. Flow lines and continuity equation. Flow tube. Bernoulli's equation. Applications. Torricelli's theorem. Venturi tube. Pitot tube. Hydraulic paradox. Friction in fluids. Stokes' Law. Friction within a fluid. Newton's formula. Poiseuille's formula. <u>Thermodynamics</u> Macroscopic and microscopic points of view. Macroscopic coordinates. Adiabatic and diathermic walls. Thermal equilibrium. Zero principle of thermodynamics. Temperature. Operational definition. Measure. Triple water point. Constant volume gas thermometer. Kelvin and Celsius scale. Types of thermometers. Thermodynamic system. Mechanical, thermal, chemical, thermodynamic equilibrium. Equation of state. P-V-T systems. Quasi-static transformations. Thermodynamic work in a p-V-T system. P-V diagrams. Adiabatic work. Internal energy. Heat. 1st law of thermodynamics. Differential form of the 1st principle. Heat capacity and specific heat: CV and CP. Specific heat of water. Calorie. Tank or heat source. Status changes. Latent heat. P-V diagram for a pure substance. Critical point and triple point. Critical isotherm. Ideal gases. Macroscopic point of view. Equation of state of ideal gases. Thermodynamic transformations of an ideal gas. Joule Experience. Internal energy of an ideal gas. Mayer's report. Isothermal, adiabatic, isochoric and isobar transformation of an ideal gas. Poisson's equations. Enthalpy. <u>Kinetic theory of gases</u> Microscopic model of an ideal gas. Kinetic calculation of pressure. Kinetic interpretation of temperature. Internal energy of an ideal gas. Specific heats of gases, degrees of freedom. Principle of equipartition of energy. Limitations of the classical kinetic model. Heat capacity of solids. Equation of state of real gases (Van Der Waals). Mean free path of the molecules of a gas. Maxwell's distribution of velocities. Experimental method of measurement. <u>Heat transfer</u> Conduction. Fourier's law. Convection. Newton's formula. Radiation. Stefan's Law. <u>Thermodynamics</u> Transformation of work into heat and vice versa. Thermal machines. Yield. 2nd law of thermodynamics. Kelvin-Planck statement. Refrigeration cycle. Coefficient of performance. Clausius' statement. Equivalence of the two statements. Reversibility and irreversibility. External and internal mechanical irreversibility. Internal and external thermal irreversibility. Chemical irreversibility. Irreversibility of natural processes. Definition of reversible transformation. The Carnot cycle. Carnot cycle for an ideal gas. Yield. Carnot's theorem and corollary. Absolute thermodynamic temperature. Clausius' theorem. Entropy. Calculation of the entropy change for an ideal gas. TS diagram. Entropy and reversibility. Change in entropy of a heat reservoir. Entropy and irreversibility. Principle of increasing entropy. Examples of entropy change calculation: heat exchange between two sources, between a body and a source, between two bodies. Entropy variation in state changes. Free expansion.
Texts and readings	P. Mazzoldi - N. Nigro - C.Voci - Fisica. Meccanica, termodinamica (Vol. 1)
Notes, additional materials	Any handouts or materials will be available by accessing the Teams room indicated below
Repository	Teams Room (UniBa) related to the course: "Teaching Material Physics 1 - Prof.

	Tommaso Maggipinto"

Assessment	
Assessment methods	The final grade is evaluated by the Commission on the basis of the results of the written and oral tests. The written test is passed if: Both exemptions are exceeded (generally the first exemption is carried out during the first semester of the teaching break, or You pass the written test indicated in the exam sessions The written test is considered passed when the student has reached at least a sufficient grade. If the written test is passed, the oral test can be taken in any session scheduled in the academic year of reference without taking further written tests. If the oral exam is not passed, then it will be necessary to take the written test again in the chosen session
Assessment criteria	The written test is an admission test to the oral exam and aims to verify the ability to solve problems related to the topics of the course. The oral exam assesses the ability to explain the topics to other people, connect different parts of the program, use the scientific language introduced in the course and the mathematical formalism in a way appropriate to the level of the course.
Final exam and grading criteria	The final grade is awarded out of thirty. The exam is considered passed when the grade is greater than or equal to 18. The maximum marks with honors (30 laude) will be awarded. Honours are awarded when the student has demonstrated full mastery of the subject.
Further information	
	.