. **- Physics**

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***Text under revision. Not yet approved by academic staff.***

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The course aims to provide students with an adequate theoretical understanding of the fundamentals of Classical Physics (Mechanics, Fluids and Thermodynamics), as well as a good ability in solving problems on the Laws of motion, forces, work and energy, necessary for acquiring "problem-solving" skills that are also useful in other curricular disciplines.

Another aim is to provide students with the language of Physics as a model for rigorous scientific communication.

At the end of the course, students should be able to:

* Recognise the types of motion and indicate the relative laws;
* Know how to solve problems using the laws of kinematics, dynamics and the principle of energy conservation;
* Know the basic principles for understanding the nature of thermodynamic phenomena;
* Apply the laws of mechanics to the study of fluids.

COURSE CONTENT

The course will cover the basic concepts of Classical Physics, starting from its description and then covering the equations of motion (Kinematics), forces (Dynamics), the action of constant and variable forces (work and energy), the applications of Fluid mechanics, and the fundamental laws of thermodynamics (zero principle, 1st, 2nd and 3rd laws of Thermodynamics). Heating and refrigeration machines and their relative yields. The functions of state (internal energy, entropy).

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|  | ECTS |
| THE SCIENTIFIC METHOD AND THE LANGUAGE OF PHYSICS. The operational definition of physical quantities; units of measure; measurement systems: IS; fundamental and derivative quantities; conversion of quantities, scientific notation; scalars and vectors. Kinematics. 1D and 2D motions; displacement, speed and acceleration; compound motions: projectile motion. Circular motions. | 0.5 |
| DYNAMICS. The concepts of force and mass. Inertia. Newton's laws. Inertial reference systems. Fictitious forces. Braking forces. | 0.5 |
| WORK AND ENERGY. Operational definition of work. Work of constant and variable forces. Kinetic energy. Theorem of living forces. Potential energy. Conservation of mechanical and total energy. | 0.5 |
| FLUIDS. Fluid statics: Stevino's law, Pascal's law; Archimedes principle. Fluid dynamics: continuity equations, Bernoulli's theorem, Torricelli's theorem and the Venturi effect. | 0.5 |
| THERMODYNAMICS. Thermal equilibrium; Zero principle of thermodynamics; Thermometric scales; thermometers; specific heats; calorimetry; latent heats; 1st principle of thermodynamics; thermodynamic transformations; 2nd principle of thermodynamics; Carnot cycle; thermal machines; entropy. 3rd Principle. | 3.0 |
| Tutorials. Exercises and problems related to Mechanics (Kinematics, Dynamics and Energy). | 1.0 |

In-depth topics not covered in the exam.

Photons, light quanta

The birth of quantum physics

Electrons and matter waves

Tunnel effect

READING LIST

Preferred texts:

RA Serway-JW Jewett, *Principi di Fisica, 5th Ed*., EdiSES, Naples, 2015.

RA Serway-JW Jewett, *Fisica per Scienze e Ingegneria, 5th Ed*., Volume 1, EdiSES, Naples, 2015.

DC GIANCOLI, *Fisica Principi e Applicazioni 3rd Ed.,* CEA.

Recommended texts:

RA Serway, JW Jewett,  *Fisica per Scienze e Ingegneria, 4th Ed*., Vol. 1, EdiSES (Naples), 2008.

D. Halliday-R. Resnick-J. Walker, *Fondamenti di Fisica*, *1st volume (Mechanics and Thermodynamics).* Zanichelli

Troubleshooting texts:

JR Gordon-RV McGrew-RA Serway-JW Jewett, *Esercizi di Fisica Guida ragionata alla soluzione,* Edises, Naples, 2010.

TEACHING METHOD

1. Frontal and dialogue-based theoretical lectures, where the key concepts of the subject are explored with a few applied examples of Physical laws;
2. Frontal practical activities with guided resolution of problems in Mechanics;
3. Exercises at home with the aid of materials provided by the lecturer on the Blackboard platform;
4. The course also includes 12 support hours where any problems are slowly reworked and solved, step by step.

ASSESSMENT METHOD AND CRITERIA

There will be both a written and an oral exam. The written exam aims to verify the student's abilities in applying physical laws relating to mechanical problems. The oral exam aims to ascertain the student's reasoning ability and theoretical knowledge of fluids and thermodynamics. During the course there is 1 optional interim test on the 1st part of the course (Mechanics); if it is not passed, there is the possibility to retake the test before the exams officially start or, alternatively, in conjunction with them. A minimum of 18/30 or 9/15 is considered the pass mark for the written test. The mark obtained in the written exam (out of 15) is added to the mark obtained in the oral exam (out of 15) to produce the final total mark (out of 30). The written exam comprises 5-6 problems of varying difficulty and, consequently, different marks; the time allowed is 2-3 hours. The oral exam comprises 4-5 questions (oral or written) covering that part of the program not covered in the written exam.

Insights into modern physics are introduced in order to provide useful cultural coordinates for students, but will not be covered in the assessment. If time permits, these topics will be addressed secondarily to the classical physics program.

NOTES AND PREREQUISITES

The language of Physics, in other words, Mathematics; basic knowledge of algebra, 1st and 2nd degree functions, powers, scientific notation, logarithms, trigonometry, function studies, derivatives and integrals. Knowledge of measurement units and calculations to the power of 10. Ability to represent graphs of time laws or tables of numerical data.

The course comes with:

* 10 hours of problem-solving practical activities in the classroom;
* 12 hours of support activities for those who encounter greater difficulties, with guided and slower solving of problems; this is aimed at preparing students to pass the interim test.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.