UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Physics Laboratory

2627-1-E3004Q005-E3004Q00502

Aims

Get a deeper understanding of the laws of mechanics and thermodynamics from the direct observation of phenomena. Learn how to perform physics measurements, elaborate data, and critically evaluate the uncertainties in the results. This course contributes in a coherent way to the bachelor's degree programme through the following learning
objectives:

Knowledge, understanding and application of the skills: Students will acquire knowledge and skills related to the operation and use of laboratory instrumentation useful to carry out physical measurements. They will acquire further knowledge using statistical methods and their application in the analysis and interpretation of experimental data and in the evaluation of the reliability of the results.

Making judgements: Students will be involved as part of a group to identify the elements characterizing a problem in the field of applied physics. The progressive acquisition of autonomy of judgment is promoted by practical and applied activities in the laboratory with the direct involvement of the student through the use of measuring instruments.

Communication skills: Laboratory activities involve the development of communication skills that consist of the ability to clearly and correctly express the results of the measurements and the investigation process related to the scientific method.

Learning skills: Students will develop an interest in deepening and expanding their skills not only on their own, but also through the exploitation of practical group activities.

Contents

Experiments: Study of motion, elastic and inelastic collisions, friction; Pendulum, springs; Torsion. Moments of

inertia; Standing waves on a spring; Acoustic waves and speed of sound; Harmonic oscillator, dumped and forced oscillations, resonance; Measurement of the gravitational constant; Coulomb law; Measurements of density, viscosity and dynamics of fluids; Calorimeter; Gas expansions and compressions; Geometric optics.

Detailed program

- Acceleration of gravity: Kater pendulum, free-fall motion
- General gravity: measurements with a Cavendish's balance
- Elastic and inelastic collisions. Inclined plane
- Torsion pendulum and measurements of inertia moments
- Hook's law. Spring and harmonic oscillations
- Forced and damped oscillations, resonance
- Steady waves on a string
- Steady waves in a pipe filled with various gases. The velocity of sound
- Stokes' law and viscosity of glycerol
- Archimede's principle and measurements of density
- Bernoulli's principle and Venturi's pipe
- Calorimetry measurement
- Thermodynamics: compression and expansion in adiabatic and isothermic regimes of various gases
- Electrostatic: measurements with a Coulomb's balance
- Geometric optics: reflection, refraction and thin lenses

Prerequisites

Basic knowledge of the contents of the course of Fundamentals of Physics.

Teaching form

Laboratory activities under the supervision of instructors and tutors. 72 hours of laboratory experiments carried out in interactive mode, in person, in groups of three students under the supervision of the teacher and tutors. All the activities are carried out at the laboratories located in Milano-Bicocca.

Textbook and teaching resource

Description of the experiments available on the e-learning page.

Semester

Second semester. The laboratory activities take place in the final part of the semester, usually during the last month.

Assessment method

1. Reports on the experiments performed in the laboratory by the group of students, written in collaboration by the three students, to be provided one week before the oral exam.
2. Oral exam, individual. The exam will concern the experiments performed in the laboratory concerning the related physics laws, the adopted instrumentation, the data-taking procedure, the data analysis, and the results. A logbook containing data taken in all experiments should be carried at the exam.

Office hours

By appointment (via email).

Sustainable Development Goals

QUALITY EDUCATION