UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics

2324-2-E3101Q130

Aims

Physics is the science that deals with describing natural phenomena with mathematics. The course provides an introduction to the main topics of classical physics, with particular attention to the application of the scientific method, the interpretation of natural phenomena, the understanding of the physical principles underlying the devices used in the daily life, using the appropriate mathematical formalism.

Contents

1. Mechanics
2. Gravitation
3. Fluid dynamics
4. Thermodynamics
5. Electrostatics and Electromagnetism
6. Optics

Detailed program

• **Part 1: Mechanics.** Coordinate systems and vectors. The cinematics of the point in one and more dimensions. Uniform rectilinear motion, uniformly accelerated, parabolic, harmonic. Newton's laws. Kinetic energy, potential energy, conservation principle. Conservative forces and not-conservative ones. Center of mass. Rigid body. Linear moment. Relative motions, Galileo’s transformations. The harmonic oscillator. The pendolum.
• **Part 2: Gravitation.** Kepler's laws. Newton's law of universal gravitation. Gravitational field. Gauss's law. Escape speed.
• **Part 3: Fluid Dynamics.** Fluids, density and pressure. Stevino's law. Pascal's principle. Archimede’s principle.

Continuity equation. Bernoulli’s equation.
• **Part 4: Thermodynamics.** Temperature and heat. Temperature measurement scales. Specific heat, latent heat. Internal energy. Zero principle. First law of thermodynamics. Thermodynamic transformations. Heat transmission (conduction, convection, radiation). Ideal gas law. Kinetic theory of gases. Van der Waals’ equation.
• **Part 5: Electrostatics and Electromagnetism.** Electric charge. Coulomb's law. Electric field. Gauss's law. Potential. Conductors. Capacitors. Electric current. Ohm's law. First and second Kirchhoff’s law for the circuits. RC circuit. Magnetic field. Earth’s magnetic field. Lorentz force. Biot-Savart law. Ampère's law. The solenoid.
• **Part 6: Optics.** Reflection and refraction of light. The human vision. The images. The rainbow. Mirages. Flat mirrors. Concave mirrors. Convex mirrors.

Prerequisites

The notions acquired in the course of Mathematical Analysis including derivatives and integrals. At the beginning of the course, a summary/review of the mathematical, algebraic and trigonometric knowledge necessary to face the course will be provided.

Teaching form

Frontal lessons (6 CFU / 48 hours)
Exercises (2 CFU / 20 hours)
The slides of each single lesson will be made available on the e-learning page.

Textbook and teaching resource

The main recommended texts are:

*Halliday Fondamenti di Fisica 7ed (vol. Meccanica e Elettromagnetismo), Casa Editrice Ambrosiana - Zanichelli.

*M.P. Giordani, G. Giugliarelli, Problemi di Fisica 1 - Meccanica e Termodinamica Casa Editrice Ambrosiana – Zanichelli

*Villa, Uguzzoni, Sioli, Esercizi di fisica - Termodinamica, fluidi, onde e relatività Casa Editrice Ambrosiana

Semester

Second year, first semester

Assessment method

The exam will consist of a written test and an optional oral test. The written test will include some problems to be

solved (questions that require the analysis of a complex phenomenon and its rationalization through the composition of one or more principles learned in the course) and some theoretical questions on the topics covered during the course.
There are 5 exam sessions: January, February, June, July and September.
The written tests passed with at least 18/30 of evaluation are considered valid for the purpose of obtaining the course credits. Students can, if they wish, also take an oral test, which can be accessed by all students who have obtained a mark of 15/30 or higher in the written test. The 30 “cum laude”/30 evaluation can only be reached with the oral exam (the maximum mark accessible with the written exam alone is 30/30). If deemed necessary for assessment purposes, the oral exam may also be requested by the teacher.

Office hours

Always, after fixing an appointment by email

Sustainable Development Goals

QUALITY EDUCATION | GENDER EQUALITY | DECENT WORK AND ECONOMIC GROWTH | INDUSTRY, INNOVATION AND INFRASTRUCTURE