UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics

2021-1-E1301Q007

Aims

The course aims to provide the basis for the physical description of nature, introducing the basic tools to represent the state and evolution of a physical system and the interactions involved, as well as providing the basic sensitivity for the experimental aspects related to measurement and evaluation of physical quantities and the main spectroscopic techniques of biological interest.
In particular:
1. The student will have to expand the knowledge and understanding of a physical problem. At the end of the course the student must know the basics of physics useful for understanding the physical processes.
2 .. At the end of the course the student must be able to apply the acquired knowledge to the subjects he will face in the following years of study and during the thesis work.
3. The student must be able to elaborate in an autonomous way what he has learned and be able to autonomously interpret the physical problems he will have to face in his school or work career.
4. At the end of the course the student will be able to express himself appropriately in the description of physical events and with exposure certainty.

Contents

The course will cover topics of:

Fundamentals of mechanics, Energy, Work and Conservation, Fluid mechanics, Thermodynamics, Electromagnetism, Optics, Overview of modern physics and spectroscopy

Detailed program

Vector description
Measurable, scalar and vector quantities, data analysis
Equations of motion
Straight, parabolic, circular, harmonious motions
Fundamental interactions and principles of dynamics
Forces and momentum, moments of forces and angular moments
Work, energy
Theorem of kinetic energy, conservative and non-conservative forces, potential energy
Conservation principles
Amount of motion and impacts, angular momentum and orbital motions, conservation of energy
Principles of fluidostatics and fluid dynamics
Laws of Pascal, Stevino, Archimede, Equation of continuity, Bernoulli's equation
Thermal energy, heat, temperature, entropy
Kinetic theory of perfect gas - I and II principle of thermodynamics
Electrostatic interactions
Electric charge, electric field - Gauss theorem - electric potential - capacity
Charge transportation
Laws of Ohm and Kirchhoff, Joule effect - currents as sources of magnetic fields
Magnetic fields and electromagnetic induction
Lorentz force, Biot-Savart law, Ampere law, Faraday law
The maxwell equations
Description of electromagnetic phenomena, Light, energy equation and momentum
Optical phenomena
Laws of reflection and refraction, interference and diffraction, microscopy
Light-matter interaction
Photoelectric effect, photons,
Quantum aspects of matter
Bohr's atom, wave function, Schrodinger's equation, spectroscopic techniques
Physical principles underlying optical spectroscopy, magnetic resonance spectroscopy, and mass spectrometry

Prerequisites

Basic knowledge of mathematical analysis is required

Teaching form

During the Covid-19 emergency period, lessons will take place in a mixed mode: partial attendance and asynchronous / synchronous videotaped lessons.

Frontal lessons alternated with exercises on the subjects carried out.

Textbook and teaching resource

J.W. Jewett & R.A. Serway “Principi di Fisica”, EdiSES, vol.1 e 2,

Semester

Second semester

Assessment method

The assessment of students' knowledge will be by written and oral examination.

In the written exam the student must solve different exercises concerning the main topics of the course (Mechanics, conservation of energy and work, fluid mechanics, electromagnetism and optics).

In the oral exam the topics covered in the course are discussed from a conceptual point of view to evaluate the acquired knowledge.

During the year three partial tasks are organized. Those who ultimately obtain an average overall mark in the partials equal to or greater than 25 can choose not to take the oral exam and accept the partial mark. Those who obtain a mark between 18 and 24 must take the oral exam.

Office hours

On Monday after lesson