UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics

2526-1-E1302Q007

Aims

The course aims to provide fundamental knowledge of Classical Physics, useful for understanding the physical phenomena underlying biological and biochemical processes.

1. Knowledge and understanding
Acquisition of basic concepts in mechanics, thermodynamics, electromagnetism, and optics.

2. Applying knowledge and understanding
Application of physical principles to solve quantitative problems and interpret natural phenomena, including those related to chemistry and biology.

3. Independent judgment
Development of critical thinking skills in analyzing physical phenomena and evaluating the most appropriate physical models to describe a given system, including biological systems.

4. Communication skills
Acquisition of the scientific language necessary to describe and discuss physical phenomena.

5. Learning skills
Enhancement of the ability to independently and critically learn basic scientific concepts.

Contents

1. Mechanics of material point and rigid body
2. Fluid mechanics
3. Thermodynamics
4. Electromagnetism

5. Optics

Detailed program

1. Measurable quantities, scalar and vector quantities, equations of motion
2. Rectilinear, parabolic, circular, and harmonic motions
3. Fundamental interactions and principles of dynamics
4. Forces and momentum, torque and angular momentum
5. Work and energy (kinetic energy theorem, conservative and non-conservative forces, potential energy)
6. Conservation principles
7. Principles of fluid statics (Pascal's law, Stevin's law, Archimedes' principle)
8. Principles of fluid dynamics (continuity equation, Bernoulli's equation)
9. Thermal energy, heat, temperature, entropy
10. Kinetic theory of the ideal gas – First and Second Laws of Thermodynamics
11. Electrostatics (electric charge and field, Gauss's theorem, electric potential, capacity)
12. Charge transport (Ohm's and Kirchhoff's laws, Joule effect, currents as sources of magnetic fields)
13. Magnetic fields and electromagnetic induction (Lorentz force, Biot–Savart law, Ampère's law, Faraday's law)
14. Maxwell's equations (description of electromagnetic phenomena, light, wave equation, energy and momentum)
15. Optical phenomena (geometrical optics, wave optics)

Prerequisites

Basic mathematics of the high school

Teaching form

32 lectures (2h) in the classroom, composed by:

a) a section focused on the presentation of contents, concepts and principles (didattica erogativa, DE).
b) a section focused on trainees interventions, guided problem-solving and discussion of practical examples, including applications in the biological (didattica interattiva, DI).

Didactic activities are conveyed by means of face-to-face lectures.

Teaching language: Italian.

Textbook and teaching resource

A. Alessandrini: "Fisica per le scienze della vita", Casa Editrice Ambrosiana. Distribuzione esclusiva Zanichelli 2023
J.W. Jewett & R.A. Serway: “Principi di Fisica”, EdiSES, vol.1 e 2

A. Giambattista: "Fisica Generale" 3/ed. McGrawHill

Semester

First semester

Assessment method

Student knowledge is assessed through a written and an oral exam.

The written exam consists of 3 problems (4 points each), 2 open-ended theory questions (3 points each), 3 short exercises (3 points each), and 3 multiple-choice questions (1 point each).
The exam must be completed on official paper provided by the instructor, and the results must be recorded on a specific answer sheet also provided by the instructor. The use of mobile phones or tablets is not allowed, but calculators are permitted.
If the written exam score is 25 or higher, students may choose to skip the oral exam and accept the grade. If the score is between 18 and 24, the oral exam is mandatory.

The oral exam involves a conceptual discussion of the course topics to evaluate the student’s understanding and knowledge.

During the academic year, three partial exams are held:

- First partial: topics 1–6
- Second partial: topics 7–10
- Third partial: topics 11–15

The format of the partial exams is the same as that of the general written exam.
If the average score across the three partial exams is 25 or higher, students may choose to skip the oral exam and accept the grade from the partials. If the average is between 18 and 24, the oral exam is mandatory.

Office hours

Mail to the instructor

Sustainable Development Goals

QUALITY EDUCATION