UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

## Physics - Turno 2

**2223-2-E3101Q130-T2**

### Aims

Physics is the science that deals with describing nature 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, and the necessary mathematical formalism.

### Contents

1. Mechanics.
2. Gravitation.
3. Fluid dynamics.
4. Waves.
5. Thermodynamics.
6. Electromagnetism.

### 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. Center of mass. Rigid body. Linear moment. Rotation and rolling motions. Angular momentum, moment of inertia, torque. Relative motions.
• Part 2: Gravitation. Kepler's laws. Law of universal gravitation. Gravitational field. Gauss's law. Escape speed. Effective potential.
• Part 3: Fluid Dynamics. Fluids, density and pressure. Stevino's law. Pascal's principle. Force of Archimedes. Continuity equation. Bernoulli equation.

• Part 4: Waves. Harmonic oscillator. Simple pendulum. Damped oscillator. Resonance. Waves. Plane wave. Period, wavelength, velocity. Reflection and interference. Stationary waves. Sound waves. Beats. Doppler effect.
• Part 5: Thermodynamics. Temperature and heat. Specific heat, latent heat. Internal energy. First law of thermodynamics. Thermodynamic transformations. Heat transmission (conduction, convection, radiation). Ideal gas law. Kinetic theory of gases. Irreversibility, entropy. Second law of thermodynamics. Thermal machines. Carnot cycle. Absolute zero.
• Part 6: 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 ciruits. RC circuit. Magnetic field. Lorentz force. Biot-Savart law. Ampere's law. Electromagnetic induction. Faraday-Lenz law. RL circuit. LC oscillation. RLC damped oscillation. Hints of magnetism in materials. Ampere-Maxwell's law. Displacement currents. Maxwell's equations. Electromagnetic waves. The speed of light.

## Prerequisites

The notions acquired in the course of Mathematical Analysis including derivatives and integrals.

## Teaching form

Frontal lessons (6 CFU / 48 hours)
Exercises (2 CFU / 20 hours)

## Textbook and teaching resource

The main recommended text is:

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

Other relevant texts are:

- P. Mazzoldi, M. Nigro, C. Voci. Elementi di Fisica, Edises.

## Semester

Second year, first semester

## Assessment method

The written tests passed with at least 18/30 evaluation are considered valid for the purposes of the course. If they wish, students can also take an oral exam. This is recommended for students who have obtained at least 25/30 marks in the written exam. The oral exam is optional and gives a score between -5 to +5 points, which will be

added to the mark of the written test. The 30 cum laude evaluation can only be achieved with the oral exam (the highest grade accessible with the written test alone is 30/30). If deemed necessary for the purposes of the assessment, the conduct of the oral exam can 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