UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

## Preparation of Didactic Experiences

**2627-1-F4002Q024**

### Aims

Main goals:

1. Knowledge and understanding

To deepen students' knowledge of the fundamentals of Experimental Physics, with particular emphasis on the methods and techniques of experimental investigation and their use in physics education, also in connection with theoretical concepts covered in previous courses.

2. Applying knowledge and understanding

To develop the ability to independently design and carry out physics experiments with educational purposes, critically selecting effective methodologies, managing instrumentation, and performing quantitative data analysis.

3. Making judgements

To foster critical thinking in interpreting experimental results, evaluating the reliability of data, and reflecting on the role of experimentation in the teaching and learning of physics.

4. Communication skills

To strengthen students' ability to organize and communicate experimental results through written reports, oral presentations, and structured discussions, using appropriate scientific language and effective visualization tools.

5. Learning skills

To promote the development of autonomous and continuous learning strategies in the context of laboratory-based physics education, enabling students to stay up to date, to innovate their teaching practices, and to adapt them to different educational settings.

## Contents

Foundation of Physics and experimental method

Basis of physics science, physics of common sense and science teaching

Introduction to history of physics

Introduction to error analysis

Science teaching

Preparation and execution of simple experiments (mechanics, thermodynamics, electromagnetism, optics)

Basis of modern physics

## Detailed program

Basis of experimental science: scientific method

History of physics and introduction to experimental physics

Role of mathematics in physics: use of mathematics in experimental sciences

Experimental approach to physics phenomenons: conduct a measurement, uncertainties and error theory, measure instruments

Scientific theories and their relation with the experiments.

Introduction to science teaching

Introduction to modern physics and quantum mechanics

## Prerequisites

General physics classes from previous years, including basis of mechanics, thermodynamics and electromagnetism.

## Teaching form

- Delivery-based Learning (DE): 28 hours of face-to-face lectures in the classroom.
- Interactive Learning (DI): 40 hours of hands-on laboratory activities and practical exercises.

## Textbook and teaching resource

### Suggested books

- J. R. Taylor, Introduzione all'analisi degli errori, Zanichelli
- S. Rosati, Fisica Generale vol. 1, CEA
- L. Lovitch, S. Rosati, Fisica Generale vol. 2, CEA
- A. B. Arons, Guida all'insegnamento della Fisica, Zanichelli
- U. Besson, Didattica della Fisica, Carocci

### Additional material

- PSSC (a cura di), Fisica (3 voll.), Quarta Edizione, Zanichelli
- F. Tibone, G. Pezzi, La Fisica secondo il PSSC, Zanichelli
- I video del PSSC, Zanichelli (reperibili sul sito della Zanichelli qui)
- R. P. Feynman, La Fisica di Feynman (3 voll.), Zanichelli
- U. Besson, M. Malgieri, Insegnare la Fisica Moderna, Carocci
- P. Doherty, D. Rathjen, Exploratorium Teacher Institute, Gli Esperimenti dell'Exploratorium (a cura di P. Cerreta), Zanichelli
- A. Rigamonti, A. Varlamov, Magico caleidoscopio della fisica, La Goliardica Pavese
- G. Johnson, I dieci esperimenti più belli, Bollati Boringhieri

## Semester

First semester

## Assessment method

Scientific report on the laboratory activity and oral exam.

At the moment we foresee that the oral exams will be held in person.

## Office hours

Please make an appointment via email.

## Sustainable Development Goals