



LABORATORIO DI FISICA II M - Z

FIS/01 - 12 CFU - Annual Tuition

Teaching Staff

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Office Hours: Martedì e Giovedì dalle ore 15:00 alle ore 17:00, a meno di impedimenti che verranno comunicati tramite la piattaforma Studium. Si suggerisce comunque di inviare una richiesta di colloquio via e-mail.

LEARNING OBJECTIVES

The approach used in this Course is experimental and applied. Learning objectives **specific** to this Course are:

- Understanding electromagnetic and optical phenomena from an experimental, practical perspective.
- Becoming skilled in assembling electric circuits, in building electric, magnetic and optical devices, and in performing measurements of physical quantities and technical specifications.
- Gaining basic knowledge about the working principles of instruments, mastering general methods and developing skills useful in investigating electromagnetic and optical phenomena not necessarily already presented in the Course.
- Gaining basic knowledge and developing skills useful in designing new devices in the concerned scientific field.
- Develop the ability to correctly analyze scientific data and to present an experiment in a good-quality scientific paper where the data are analyzed and results are presented and interpreted. Develop the ability to communicate the results of a scientific measurement or experiment in an exhaustive, clear, efficient and correct fashion.

In addition, in the frame of the so-called **Dublin Descriptors**, this Course helps attain the following cross-disciplinary competences:

Knowledge and understanding:

- Inductive and deductive reasoning.
- Ability to formalize the description of a natural phenomenon in terms of scalar and vector physical quantities.

- Ability to formulate a problem using suitable mathematical relationships (such as algebraic, integral or differential) among physical quantities, and then solve it by means of analytical or numerical methods.
- Ability to arrange and set up a simple experimental apparatus, and to use scientific instruments for thermal, mechanical and electromagnetic measurements.
- Ability to perform statistical analysis of data.

Applying knowledge and understanding:

- Ability to apply the gained knowledge in order to describe physical phenomena using rigorously the scientific method.
- Ability to design simple experiments and perform analysis of their experimental data in all domains of Physics including those with technological spinoff.

Making judgements:

- Developing critical thinking.
- Ability to find the best methods to critically analyze, elaborate and interpret experimental data. Ability to understand the predictions of a theory or model.
- Ability to evaluate accuracy of measurements, linearity of instrumental response, sensitivity and selectivity of employed techniques.

Communication skills:

- Ability to orally present, using fluent scientific language and appropriate scientific vocabulary, a scientific topic, including any underlying motivations and illustrating any results.
- Ability to report in writing, using fluent scientific language and appropriate scientific vocabulary, on a scientific topic, including any underlying motivations and illustrating any results.

COURSE STRUCTURE

This course alternates 3 cycles of lectures in the Classroom with 3 corresponding cycles of practical sessions in the Lab. The course begins with a first cycle of lectures in the Classroom, which is followed by a corresponding first cycle of practical sessions in the Lab. Then we continue with the second cycle of lectures in the Classroom, and so on.

The classroom lectures introduce the working principles of scientific instruments and present the experimental setups of some experiments aimed at illustrating electromagnetic and optical phenomena, at verifying natural laws, and at measuring physical properties in the same fields. Procedures to analyze and ways to present the data that will be collected in the Lab are specifically highlighted.

During the cycles of practical sessions in the Lab the students actually perform the experiments and make the measurements previously introduced by the Classroom lectures.

During the periods devoted to lectures in the Classroom there are NO sessions in the Lab. During the periods devoted to practical sessions in the Lab there are NO lectures in the classroom.

7 CFUs (corresponding to 7 hours each) are dedicated to lectures in the Classroom for a total of 49

hours, while 5 CFUs (corresponding to 15 hours each) are devoted to the practical sessions in the Lab with a total of 75 hours. Altogether, thus, this 12-CFU Course comprises 124 hours of teaching.

DETAILED COURSE CONTENT

Description and subsequent execution of 26 experiments aimed to measure physics quantities and/or to verify physical laws in the fields of electromagnetism and optics. Analysis of the collected experimental data.

The detailed program is listed in the Section "Programmazione" (in Italian only).

TEXTBOOK INFORMATION

The teacher does not follow any textbook specifically, but utilizes material from different sources. Studying the slides shown during the lectures is normally adequate to pass the exam.

For the laboratory experiments, Instruction Manuals are provided. They can also be downloaded from the

Course web site (in Italian only): Instructions.

For students who wish to dwell deeper into the subjects of the Course, the following list is a selection of textbooks and other material concerning data analysis methods, electrical and optical instrumentation used in this Course, and related experimental procedures.

A. FOTI, C. GIANINO: **Elementi di analisi dei dati sperimentali**, Liguori Ed., Napoli

J. R. TAYLOR: **Introduzione all'analisi degli errori**, Zanichelli Ed., Bologna

ISO(Int.Standard Org.): **Guide to the Expression of Uncertainty in Measurement**, Ginevra

L. KIRKUP, B. FRENKEL: **An Introduction to Uncertainty in Measurement**, Cambridge University

Press

L. G. PARRAT: **Probability and Experimental Errors in Science**, Wiley & Sons Inc., N.Y. F.

TYLER: **A Laboratory Manual of Physics**, Edward Arnold Ed., London

M. SEVERI: **Introduzione alla sperimentazione fisica**, Ed. Zanichelli, Bologna E. ACERBI: **Metodi e strumenti di misura**, Città Studi Ed., Milano

G. CORTINI, S. SCIUTI: **Misure ed apparecchi di Fisica (Elettricità)**, Veschi Ed., Roma

R. RICAMO: **Guida alle sperimentazioni di Fisica, Vol. 2°**, Casa Editrice Ambrosiana, Milano

F. W. SEARS: **Ottica**, Casa Editrice Ambrosiana, Milano

G. E. FRIGERIO: **I laser**, Casa Editrice Ambrosiana, Milano
