# Experimental Physics (with Workshop on Teaching Physics)

## Prof. Claudio Giannetti

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The general aim of the course is to provide the basic knowledge and fundamental concepts needed to teach physics topics in the primary and nursery school syllabus. Specifically, the course aims, through the analysis of some paradigmatic physical phenomena and exemplary lab experiences, to help students to discover and understand the methodological nature of physics, namely the decomposition of a natural phenomenon in simple mathematical models, which allows for a quantitative description. The course includes a compulsory workshop consisting of basic teaching activities appropriate for school and which can be replicated in class. Emphasis will be placed on the methodological aspects related to the scientific description and interpretation of nature.

At the end of the course, students will be able to:

1. build educational pathways structured around the most important physical phenomena;
2. develop the specific language of the discipline and a competence that exploits all the technologies and computer devices of common use (tablets, smartphones, computers, LIM);
3. build structured educational pathways aimed at favouring abstraction, reasoning and problem-solving using the experimental method.

***COURSE CONTENT***

The structure of the course is based on the *national guidelines for primary school and first cycle of education syllabus* (2012). During the course, various concepts and experimental observations will be introduced with the aim of understanding the principles of physics underlying many daily phenomena.

The course topics will include:

1. Introduction to physics: observing, measuring and modelling reality
2. The concept of space, time and motion.
3. Force, mass and acceleration.
4. The concept of Energy and Work and different types of force
5. Waves
6. Light and colours, phenomena of refraction, diffraction, and interference
7. The concept of temperature and heat
8. States of matter (gas, liquid and solid) and transition from one state to another
9. The fundamental components of matter: atoms, electrons

***READING LIST***

Students will need a secondary-school physics textbook which covers the traditional physics syllabus (mechanics, fluids, electricity, magnetism, heat, waves, sound, light). For example:

* S. Mandolini, *Le Parole della Fisica.azzurro* (single volume), Zanichelli 2012.
* U. Amaldi, *L’Amaldi.blu* (single volume), Zanichelli 2014.
* G. Ruffo, *Fisica - Lezioni e Problemi*, (single volume), Zanichelli 2010.

During the course students will receive additional material (ex. slides, notes, recorded lectures, virtual tools, video material) relevant for the topics addressed by the lectures (through Blackboard).

***TEACHING METHOD***

The course consists of lectures and discussions between groups of students in which the exchange of ideas will be stimulated by means of specific questions and activities. Additional materials available to students will be provided through the Blackboard platform available on the University's website. In parallel to frontal lectures, a *compulsory* workshop activity will be carried out involving simple experiences that can be reported in class.

***ASSESSMENT METHOD AND CRITERIA***

Students will be assessed on work carried out during the workshop and through an oral test.

The oral test assesses students’ level of assimilation of the basic concepts of physics illustrated during lectures and their ability to provide concise and informative answers to the questions posed during the exam. The oral exam will take into account students’ accuracy and level of assimilation of concepts presented during the course, as well as their re-elaboration in terms of conceptual organisation: cause/effect, state/transformation, equilibrium and energy.

Assessment of the workshop activities consists in developing a path and preparing an authentic project, inspired by one of the experiences from the workshop itself. Students will be assessed on their ability to translate notions of physics into a language and style appropriate for primary and nursery schools. Passing the workshop is a prerequisite to pass the exam. A maximum of 2 points will be added to the mark obtained during the oral exam (from 0 to 30/30) depending on the evaluation achieved in the Workshop (A corresponds to up to 2 points added to the oral mark, B corresponds up to 1 point added to the oral mark, C corresponds up to 0 points added to the oral mark). The integration of the oral exam mark with additional points, based on the assessment obtained in the workshop, is not intended as an automatic mark increase. The lecturer may ask questions to verify the student’s effective acquisition of the work done in the workshop.

***NOTES AND PREREQUISITES***

As it is introductory in nature, there are no prerequisites for attending the course, apart from a basic knowledge of mathematics.

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.