UNIVERSITÀ degli STUDI di CATANIA

DEPARTMENT OF PHYSICS AND ASTRONOMY
Bachelor's Degree in Physics
Academic Year 2018/2019 - 1° Year

PHYSICS LABORATORY I A - L

FIS/01 - 12 CFU - Annual Tuition

Teaching Staff

SILVIO CHERUBINI

Email: silvio.cherubini@unict.it
Office: Edificio 6, Cittadella Universitaria, 95123 Catania
Phone: 095.3785237 (DFA) - 095.542665 (LNS)
Office Hours: Lunedì 9:00-11:00, studio n. 217, DFA. Monday 9:00 a.m. - 11:00 a.m., Room 217, DFA. Martedì 9:00-11:00, SDS Architettura (SR), solo su prenotazione con 48 h di anticipo MINIME.

LEARNING OBJECTIVES

This is the first class that teaches the students Laboratory techniques and Statistics after they enroll in the undergraduate Physics course.

The aim of the course is to provide students with the basics for learning the experimental method and experimental data analysis techniques. It is divided into frontal lessons (42 hours) and laboratory exercises (90 hours).

At the end of the course the successful student will be able to perform measurements of physical quantitites and report the results in a scientifically correct way.

COURSE STRUCTURE

Teaching is done through lectures in which the topics listed in the section "course contents" are discussed. A continuous interaction with the students is foreseen.

The practical laboratory exercises are conducted in the presence of the teacher, the laboratory technician and any tutors (if assigned). The laboratory presentation of the various experiences available in the laboratory are also part of the laboratory activities.

From this year, visits to the research facilities of the Catania area will be part of the course. The hourly commitment of this activity, estimated in about three (3) hours for each visit, will be considered 50% in the calculation of the hours of lectures and 50% in those of laboratory activities. The method of is being defined.

DETAILED COURSE CONTENT

The course is accredited by 12 CFUs, corresponding to 132 hours of classroom and laboratory lectures. In particular, 42 hours of classroom lessons and 90 hours of guided laboratory experiences are provided.

Experimental Method and data analysis (22 hours).

- The Scientific Method. - Measurement of physical quantities. Operational determination of a physical quantity and its measurement. Fundamental and derived quantities. Units of measure and systems of units of measure: the international system and CGS system. - Presentation of Significant Measures and Figures. Dimensional analysis of a formula and verification of its correctness - Characteristics of a measuring instrument - Errors and / or uncertainties. Systematic and random errors. - Total error in measurements, relative error, precision degree. - Single and / or multiple measurements. The best estimate of error (fashion, median and average) - Scarcity, mean square deviation, standard population, sample and mean deviation - Error propagation. - Representation of data: tables, histograms and graphs. - Histograms: from discrete to limit distribution. - Gauss distribution as a limit distribution for measurements affected by random errors. - Measurement of a magnitude fl uenced by random phenomena and estimation of expected value. - Measurement in probabilistic terms. probability theory.- The criterion of maximum likelihood.- Probability distributions: Gaussian, Binomial, Poisson.- Chi-quadro test.- Graphics and functional relations- Description of laboratory experiences

Statistics (20 hours)

Random events, random variables - classical, frequent and axiomatic probability of probability - total probability, probability conditional, composite probability - Bayes theorem - statistical convergence - statistical independence and covariance - statistical population - sampling - large number law - mathematical hope for variables discrete and continuous randoms - probability density - moments - generating functions of the moments and characteristic function - Bernoulli distribution • Poisson distribution • Gauss distribution • Student distribution • distribution $\chi 2$ • central limit theorem • Statistical indices and their sample estimates

Laboratory Experiences (90 Hours)

Attendance of 75% of the laboratory activities is compulsory.

a) Dynamics of the material point and the rigid body

Length Measurements: Nio, Caliber, Palmer • Sloping Plane • Fletcher Device • Atwood Machine • Simple Pendulum • Composite Pendulum, Kater Reversible Pendulum • Spherical Pendulum, Spherometer • Arched Pendulum • Twist Pendulum • Maxwell Needle • Springs • Inertia moment of a flywheel • Kinetic rotation energy.

b) Mechanism of deformable continuous

Picnometer • Mohr-Westphal scale • Ostwald viscometer - Stalagmometer • Tensiometer • Venturi tube • Sedimentation.

c) Thermodynamics

Regnault mixing calorimeter • Heat propagation in a homogeneous bar • -Equipment of perfect gas status • Desormes and Clement's experience • Kundt tube

d) Verify the probability distribution by a Galton Machine - Verification of probability distribution of a sample of standard industrial production items.

TEXTBOOK INFORMATION

1. P. R. Bevington, D. Keith. Data Reduction and Error Analysis for the Physical Science
2. A.Foti, C.Gianino: Elementi di Analisi dei dati sperimentali, Liguori, Napoli
3. M. Loreti: Teoria degli Errori e Fondamenti di Statistica, Decibel, Padova
4. R. Ricamo: Guida alle Esperimentazioni di Fisica Ed. Ambrosiana, Milano
5. E. Perucca: Fisica Generale e Sperimentale UTET, Torino
6. F. Tyler: A Laboratory Manual of Physics E.Arnould, London
7. slides and lecture notes
