Academic subject:			
Degree Class: L-35 – Scienze Matematiche		**Degree Course:** Mathematics	**Academic Year:** 2018/2019
		Kind of class: Optional	**Year:** 2 / **Period:** 1
			ECTS: 7 divided into **ECTS lessons:** 3 **ECTS exe/lab/tutor:** 4
Time management, hours, in–class study hours, out–of–class study hours lesson: 56 exe/lab/tutor: 32 in–class study: 56 out–of–class study: 119			
Language: Italian	**Compulsory Attendance:** strongly recommended		
Subject Teacher: Enrichetta Maria FIORE	**Tel:** +39 080 5443184 **e–mail:** enrichettamaria.fiore@uniba.it	**Office:** Physics Department, room R-47	**Office days and hours:** After agreed appointment
Prerequisites: General Physics, Analytical Geometry, Differential Calculation			
Educational objectives: Introduction to the basic methods of experimental physics by developing the ability to identify the essential aspects of physical phenomena and critical logical abilities to propose and / or verify phenomenological models capable of describing them.			
Expected learning outcomes (according to Dublin Descriptors)	**Knowledge and understanding:** Acquisition of the knowledge and skills necessary to independently conduct an experiment for verifying the laws of physics. The knowledge will be acquired through theoretical lessons **Applying knowledge and understanding:** Acquisition of the basics knowledge to collect data, analyze them and interpret them critically. These skills will be acquired through classroom and laboratory exercises. **Making judgements:** Development of critical interpretation and evaluation capabilities of experimental data also in order to identify appropriate solutions and improvement strategies. These skills can be developed in the discussion with the teacher of the examples proposed during the lessons and exercises. **Communication:** Skills development in - relationship in group work; - communications of their results correctly to non-specialist interviewees. The result can be achieved by writing reports of practical experiences carried out in groups in the laboratory. **Lifelong learning skills:** Accomplishment of the ability to grow autonomously with own knowledge and skills for following a continuous upgrade path over time. To this end, students will be asked to review the knowledge acquired in previous courses, necessary to understand and develop the theoretical topics and to carry out laboratory experiences.		
Course program The scientific method. Physical quantities and their measurement. Uncertainties in measurements of physical quantities. Catalog of uncertainties. Measuring instruments and their properties. Best measurement estimate.			

Uncertainty estimation. Significant measures, uncertainties and significant figures. Comparison between measurement and expected value and between measurements. Organization and presentation of data.
Definition of probability. Main properties of probability. Discrete and continuous random variables. Probability Distributions. Expected value and variance. The Gauss distribution and the standardized variable. Principle of maximum likelihood. Estimation of Gauss Distribution Parameters. Probability of standard deviation. Probability of obtaining a result in a measurement operation. The central limit theorem. Presentation of the result of a measure and intervals of confidence. Verification of hypotheses and significance. Weighted average.
Adaptation of a functional relationship to experimental data. Graph method. Minimal square method. Weighing least squares method. Estimate uncertainty about the parameters of the straight line. Estimate of uncertainty on an interpolated value.
Linear correlation coefficient. Covariance and correlation.

Teaching methods:
classroom and laboratory lectures and exercises

Auxiliary teaching:
material supplied by the teacher

Assessment methods:
The final evaluation will take place through an oral test in which the student, starting from the discussion of an experience carried out in the laboratory, will have to demonstrate
• have acquired the fundamental theoretical knowledge to perform measurements, analyze and interpret them;
• to know how to express them in a clear form and with properties of language.
The vote will also take into account the interlocutory capacity demonstrated during lectures and exercises as well as the group relationships produced during the year at the end of each laboratory exercise.

Bibliography:
G. Ciullo, Introduzione al laboratorio di fisica, Springer
G. Cannelli, Metodologie sperimentali in Fisica, EdiSES