UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO INTERUNIVERSITARIO DI FISICA

General information	
Academic subject	CLASSICAL PHYSICS LABORATORY II
Degree course	Bachelor Degree in Physics
Academic Year	Second
European Credit Transfer and Accumulation System (ECTS)	8
Language	Italian
Academic calendar (starting and ending date)	2nd Semester (February – June 2023)
Attendance	Lecture Attendance: Not Compulsory Laboratory Attendance: Compulsory

Professor/ Lecturer	
Name and Surname	Salvatore My
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Department and address	Office R12 – Dipartimento Interateneo di Fisica – Campus Universitario – Via E. Orabona, 4 Bari
Virtual headquarters (Microsoft Teams code)	MS Teams Virtual Classroom (code: s3me0ls)
Tutoring (time and day)	Tuesday, from 4:00 to 6:00 pm or on appointment also in other days (tutoring can be either in the office or in the virtual classroom)

Syllabus	
Learning Objectives	To learn the basics on - Theoretical and experimental direct current (DC) and alternating current (AC) circuit analysis - Theoretical and experimental analysis of optical phenomena
Course prerequisites	- Classical Physics Laboratory I - Electromagnetic laws
Contents	Electric Circuits - Ideal and real components. - Resistors, capacitors, inductors. - Generators. - Topology in circuit analysis. Measurements in DC circuits - Kirchhoff laws and their application. - Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem. - Current, Voltage and Resistance measurements with analog and digital instrumentation. - Uncertainty in electrical measurements. Measurements in AC circuits - Periodic, aperiodic, and random signals. - Fourier Analysis. - Alternating Circuits and their solution. - The symbolic Methods. - RC circuit, low-pass, and high-pass filters. - RL circuit. - RLC circuit. - Compensated voltage divider. - Measurement Instruments of alternating signals. - Amplitude, phase, and time measurements with the oscilloscope. Pulsed Circuits - Laplace Transform - Step and square signals.

	- RC circuit. LTspice Simulator Optics - Light and refractive index. - Fresnel coefficients and Snell's law. - Energy partition in reflection and refraction of electromagnetic waves. - Huygens-Fresnel principle and Snell's law. - Fermat's principle and Snell's law. - Light dispersion. - Brewster's angle and polarization of light by reflection. - Geometrical optics. - Optical elements. - Astigmatism. - Gaussian optics. - Mirrors, Diopters, Lens. - Aberrations. - Human eye as optical system. - Optical instruments: magnifying glass, telescope (Kepler, Galileo), microscope, optical fiber. Laboratory experiments foreseen: 1. Study of the current-voltage characteristic of a conducting element and measurement of the resistance using the ammeter-voltmeter method. 2. Resistance measurement with the Wheatstone bridge method. 3. Charge and discharge of a capacitor: measurement of capacitance. 4. Study of a RLC series circuit 5. Study of low-pass and high-pass filters with alternating and square wave signals. 6. Sodium spectrum analysis with a grating spectrometer. 7. Refractive index measurement of solid by the prism spectrometer. 8. Focal length of an optical system measurement using both imaging conjugates and Bessel method.
Books and bibliography	• Lecture notes Specific books on electric circuits and measurement instruments: • R. Bartiromo, M. De Vincenzi – Electrical Measurements in the Laboratory Practice – Springer • R. Perfetti – Circuiti Elettrici – Zanichelli • Acerbi - Metodi e strumenti di misura – Città studi Specific book for optics: • Textbooks of Physics II including optics.
Additional materials	Specific books to deepen the uncertainties treatment: • Taylor-Introduzione all'analisi degli errori-Zanichelli • BIPM – Evaluation of measurement data – Guide to the expression of uncertainty in measurement - https://www.bipm.org/en/publications/guides/gum.html

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
200	48	30	122

ECTS			
8	6	2	

Teaching strategy	
	Lectures on physics background and students' team working in laboratory

Expected learning outcomes	
Knowledge and understanding on:	Knowledge and understanding on the measurement methods of electromagnetic quantities and their usage limits.
Applying knowledge and understanding on:	The students will acquire the ability to use laboratory instruments and to realize the best measurement setup to the quantity under measurement and to analyse the reliability and the uncertainties of the measurement results.
Soft skills	• **Making informed judgments and choices** Students will be stimulated to acquire an autonomous and critical reasoning on methods and measurement results interpretation • **Communicating knowledge and understanding** Students will be able to use clear, appropriate, and scientifically rigorous language both in the written tests and in the oral discussion about electric circuits and optics phenomena. • **Capacities to continue learning** Students will have acquired the skills necessary to undertake subsequent studies that include laboratory topics and measurements of electromagnetic quantities with a high degree of autonomy

Assessment and feedback	
Methods of assessment	Final Exam is an oral test covering all the topics taught in class and in laboratory. To be admitted to the final exam it is necessary to submit the reports on all the experiments carried out in the laboratory, in advance. The exam begins with the discussion of one of the submitted reports, chosen by the Examination Committee, followed by a few questions on the topics other than one on the report. To pass the exam, students will have to demonstrate that they have well understood the contents of the course. Preliminary signing up on ESSE3 is compulsory.
Evaluation criteria	• **Knowledge and understanding** Students will have to demonstrate knowledge and understanding of the laws underlying electrical circuits and optical phenomena • **Applying knowledge and understanding** Students will have to prove that they know and know how to apply the laws underlying electrical circuits and optical phenomena for the measurement of some electromagnetic quantities • **Autonomy of judgment** Students must show that they have acquired autonomy and critical reasoning skills on the topics covered in the teaching. • **Communicating knowledge and understanding** Students should be able to explain the laws and measurement methods studied using clear, appropriate, and scientifically rigorous language. • **Capacities to continue learning** Students must be able to independently examine and investigate challenges where the use of the laws of physics is required and of the laws of electromagnetic phenomena.
Criteria for assessment and attribution of the final mark	The grade, out of thirty, will reflect the degree of knowledge of the course contents and of the experimental methodology applied in the laboratory experiences. The exam is passed when the grade is greater than or equal to 18. Full understanding of the subject, exposure clarity, language accuracy guarantees

	the maximum mark, 30 cum laude.
Additional information	