University of Gdańsk

Subject card

Subject name and code	Electromagnetism and Basics of Surveying Laboratory, PG_00182301		
Field of study	Physics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish polish
Semester of study	3	ECTS credits	4.0
Learning profile	academic	Assessment form	credit
Conducting unit	Institute of Experimental Physics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Krzysztof Dorywalski	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	60.0	0.0	0.0	60
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	60	0.0	40.0	100

Subject objectives	Introducing students to the fundamental phenomena of electromagnetism and to measurement methods and instruments, while developing the ability to perform and analyze physical experiments using measurement devices and basic electronic circuits.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZL3_U05] can apply the formalism of classical electrodynamics and Maxwell's equation to describe electric and magnetic fields in vacuum and in material media and in electrical circuits, and to classify material media according to the way they interact with an external electromagnetic field	The student is able to apply the laws of classical electrodynamics and Maxwell's equations to interpret the results of measurements of voltage, current, resistance, and the parameters of alternating signals. The student can analyze the properties of simple electrical circuits (RC, RL, RLC) and passive and semiconductor components based on experimental investigations, as well as describe the interaction of electric and magnetic fields in a vacuum and in basic material media, relating them to the results obtained in the laboratory.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
	[FIZL3_W13] knows measuring instruments, their construction and principle of operation as well as the use of simple electronic systems	The student possesses knowledge of basic measuring instruments used in electrical measurements, understands their construction and operating principles, and can use them to perform measurements of fundamental electrical and magnetic quantities as well as to analyze simple electronic circuits. The student is also able to determine the applications of basic electronic components and circuits.	[SW2] presentation/project/paper/ report [SW5] implementation of a problem task
	[FIZL3_U02] has the ability to perform measurements of basic physical quantities; is able to develop, describe and present the results of physics experiments and computer simulations; is able to perform quantitative analyses and formulate qualitative conclusions on this basis; can estimate measurement uncertainties	The student is able to perform measurements of fundamental electrical and magnetic quantities using measuring instruments such as a multimeter, oscilloscope, and frequency meter. The student can process and present experimental results using selected computational packages, carry out quantitative analysis, draw qualitative conclusions, and estimate measurement uncertainties associated with the conducted experiments.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU6] demonstration of practical skills
	[FIZL3_W14] knows the principles of ergonomics and occupational health and safety	The student knows the principles of ergonomics and occupational health and safety in the electromagnetism and metrology laboratory.	[SW5] implementation of a problem task
	[FIZL3_K07] has a sense of responsibility for jointly performed tasks	The student collaborates responsibly within a group during the execution of laboratory tasks and research reports, meets deadlines, performs assigned duties diligently, and contributes to the overall results of the team.	[SK2] presentation/project/paper/ report [SK5] implementation of a problem task [SK6] demonstration of practical skills [SK8] observation of student's independent or team work
	[FIZL3_U15] can work in a team, plan and organize his/her own work and in a team	The student is able to work in a team during laboratory tasks and to plan and organize both their own work and the team's activities to ensure effective completion of the assigned laboratory tasks.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
	[FIZL3_W07] knows and understands electromagnetic phenomena, laws of electrodynamics and the consequences of Maxwell's equations	The student knows and understands fundamental electromagnetic phenomena and the laws of electrodynamics, can relate them to the consequences of Maxwell's equations, and use them to interpret the results of laboratory experiments involving electric and magnetic fields as well as electrical circuits.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task

Course outcome	Subject outcome	Method of verification
[FIZL3_W03] knows how to plan and perform a physical experiment and analyze the results obtained; knows the elements of the theory of measurement uncertainty in application to advanced physics experiments, knows the basic units of the SI system and its most important derived units; knows other systems of units of measurement	The student is able to plan and conduct simple experiments in electromagnetism, process and analyze measurement results, and estimate the associated uncertainties. The student knows the basic SI units related to electromagnetism and their application in laboratory measurements.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[FIZL3_W02] understands the role of physical experiments, mathematical theoretical models that bring reality closer and computer simulations in the methodology of scientific research; is aware of technological, instrumental and methodological limitations in scientific research	The student understands the role of experiments in verifying the laws of electromagnetism, can relate measurement results to theoretical mathematical models, and is aware of the limitations of measuring instruments and methods used in laboratory research.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task

Subject contents

1. Introduction to the laboratory, health and safety rules, and handling of measuring instruments.
2. Measurement of voltage, current, and resistance using a multimeter and oscilloscope; determination of AC signal parameters.
3. Study of series and parallel electrical circuits: Ohms law and Kirchhoffs laws.
4. Investigation of the characteristics of passive components (resistors, capacitors, inductors).
5. Measurement of electric and magnetic fields.
6. Examination of Faradays law and electromagnetic induction.
7. Analysis of RC, RL, and RLC circuits: measurement of time and frequency characteristics.
8. Study of semiconductor components: diodes and transistors.
9. Construction and measurement of simple measurement systems using operational amplifiers and sensors.
10. Investigation of selected integrated circuits: voltage regulators, timing circuits, and logic circuits.

Prerequisites and co-requisites

Basic knowledge of electrodynamics and general physics, as well as the ability to process measurement data.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
report	51.0%	80.0%
short test	51.0%	20.0%

Recommended reading	Basic literature	- Laboratory materials and instructions provided by the instructor - P. Horowitz, Sztuka elektroniki 1, WKŁ 2018 - A, Chwaleba, B. Moeschke, G. Płoszajski, P. Majdak, P. Świstak, Podstawy elektroniki, Wydawnictwo Naukowe PWN, 2021 - P. Bilski, M. Dobies, A. Kozak, M. Makrocka-Rydzyk Materiały do ćwiczeń ze wstępu do pracowni fizycznej. Normy ISO i matematyka w laboratorium Wydawnictwo Naukowe UAM, Poznań 2014 - J. R. Taylor, Wstęp do analizy błędu pomiarowego, PWN, 1995
	Supplementary literature	not applicable
	eResources addresses	
Example issues/ example questions/ tasks being completed	not applicable	
Work placement	Not applicable	

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