University of Gdańsk

Subject card

Subject name and code	Electromagnetism , PG_00204537						
Field of study	Nuclear safety and radiological protection						
Date of commencement of studies	October 2026		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	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	6.0			
Learning profile	academic		Assessment form	exam			
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Ryszard Drozdowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	45.0	0.0	0.0	0.0	90
	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	90	0.0	90.0	180

Subject objectives	Understanding: - the laws of electrostatics - the behavior of free charges in an electromagnetic field - the laws and effects associated with the flow of direct and alternating current - the relationships between magnetic fields and the currents that generate them - the mechanism of electromagnetic wave generation - the principles of operation and use of various types of electrical devices used in metrology, industry, and everyday life - the effects of electromagnetic radiation on biological tissues

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BJORL3_W01] Has an advanced knowledge and understanding of the main concepts and principles of nuclear physics and chemistry, understands their historical development and significance not only for nuclear safety and radiation protection, but also in the context of the fundamental dilemmas facing modern civilization.	Student understand the laws of electrostatics and magnetostatics. He understand the laws of direct and alternating current flow and the importance of electric current for economic development. Furthermore, student understand how electromagnetic waves are generated and the importance of using them for information transfer and medical diagnostics. Students also understand the effects of electromagnetic radiation on biological tissues.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
[BJORL3_W02] Has an advanced understanding of the role of physical and chemical experiments, mathematical theoretical models approximating reality, and computer simulations in scientific research methodology; is aware of technological, apparatus, and methodological limitations in scientific research.	The student knows: - what methods can be used to electrify bodies and how to store electric charges, - how to generate direct and alternating electric current and what are the effects of current flowing through a given material medium, - how to generate direct and alternating magnetic fields and what are the effects of their interaction with matter, - what phenomena can be used to measure the intensity of direct and alternating current, - what are the operating principles of DC and AC ammeters and voltmeters, galvanic cells, transformers, DC and AC generators, and electric motors? - how to generate and receive electromagnetic waves, and how to use them to transmit information? - the effects of electric and magnetic fields on organisms.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
[BJORL3_W05] Has advanced knowledge of the elementary components of matter and the types of fundamental interactions between them, the manifestations of these interactions in phenomena occurring at scales ranging from subatomic to subatomic, knows the time and energy scales associated with these phenomena.	The student knows: - what are the elementary carriers of electricity? - what methods can be used to electrify bodies and how to accumulate electric charges? - what is the mechanism of generating magnetism in matter? - how to generate constant and variable magnetic fields? - how to generate and receive electromagnetic waves? - the effects of electric and magnetic fields on living tissues.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
[BJORL3_U01] Can formulate the laws of physics and chemistry using mathematical formalism.	The student is able to: - apply elements of field theory to describe electromagnetic phenomena - write Maxwell's equations in differential and integral form - present solutions to Maxwell's equations and provide their interpretation.	[SU1] oral statement/conversation/ discussion [SU3] text preparation/written work [SU4] test/exam - oral or written

Course outcome	Subject outcome	Method of verification
[BJORL3_U03] Is able to use the formalism of physics and chemistry to describe phenomena in the microworld.	The student is able to: - calculate the electric field strength and electric potential of a system of electric charges, - calculate the capacitance of a system of capacitors, - calculate the resistance of a system of resistors and the distribution of currents flowing through them, - calculate the magnetic field strength generated by a system of current-carrying conductors, - calculate the electromotive force generated in conductors moving in a magnetic field, - calculate the electrodynamic force acting on current-carrying conductors in a magnetic field, - write Maxwell's laws and use them to derive the electromagnetic wave equation, - calculate the energy transferred by an electromagnetic wave.	[SU1] oral statement/conversation/ discussion [SU3] text preparation/written work [SU4] test/exam - oral or written

Subject contents

1. Mathematical introduction - elements of vector analysis and field theory
2. Electric charge.
3. Electric field.
4. Magnetic field.
5. Electrical and magnetic properties of substances.
6. Generation of electric currents.
7. DC and AC circuits.
8. Maxwell's equations in vacuum and matter.
9. Electromagnetic waves
10. Elements of electrical engineering
11. The effects of electromagnetic radiation on living tissue

Prerequisites and co-requisites

A student who has passed the "Mechanics" subject can attend the classes.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
not applicable	51.0%	45.0%
not applicable	0.0%	5.0%
not applicable	51.0%	50.0%

Recommended reading

Basic literature	D. Halliday, R. Resnick, J. Walker, Podstawy fizyki Tom III, IV Wyd. Nau J. Orear, Fizyka, Tom II, Wydawnictwo Naukowo-Techniczne, 1979. A. K. Wróblewski, J. A. Zakrzewski, Wstęp do fizyki tom 2 część 2, PWN I. V. Sawieliew, Wykłady z fizyki, PWN, Warszaw 1987; E. Koziej, B. Sochoń, Elektrotechnika i elektronika, PWN Warszawa 198 A. Hennel, W. Szuszkiewicz, Zadania i problemy z fizyki, PWN, 1993. J. Kalisz, M. Massalska, J. M. Massalski, Zbiór zadań z fizyki z rozwiąza J. Jędrzejewski, W. Kruczek, A. Kujawski, Zbiór zadań z fizyki dla kandy Techniczne, 1984. W. Barański, M. A. Herman. L. Widomski, Zbiór zadań z fizyki. Elektrycz
Supplementary literature	not applicable
eResources addresses	

Example issues/ example questions/ tasks being completed

not applicable

Work placement

Not applicable

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