

Subject card

Subject name and code	Electromagnetism and Radiation, PG_00167353						
Field of study	Elektromagnetyzm i promieniowanie						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
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		7.0		
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_U03] is able to use the formalism of physics and chemistry to describe phenomena in the microworld; is able to use the methodology of biology and ecology to an elementary extent when describing the effects of radiation on biological objects and in the environment	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] wypowiedź ustna/rozmowa/ dyskusja [SU3] opracowanie tekstowe/ praca pisemna [SU4] test/egzamin - ustny lub pisemny
	[BJORL3_W02] Understands the role of physical and chemical experimentation, 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/egzamin - ustny lub pisemny [SW1] wypowiedź ustna/rozmowa/ dyskusja [SW3] opracowanie tekstowe/ praca pisemna
	[BJORL3_U01] can formulate the basic 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] wypowiedź ustna/rozmowa/ dyskusja [SU3] opracowanie tekstowe/ praca pisemna [SU4] test/egzamin - ustny lub pisemny
	[BJORL3_W01] has a general knowledge of the basic concepts and principles of nuclear physics and chemistry, understands their historical development and their importance not only for nuclear safety and radiation protection, but also for understanding the modern world; has a basic knowledge of biology and ecology	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/egzamin - ustny lub pisemny [SW1] wypowiedź ustna/rozmowa/ dyskusja [SW3] opracowanie tekstowe/ praca pisemna

	Course outcome	Subject outcome	Method of verification
	[BJORL3_W05] has 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; knows the basics of biology and ecology in understanding the biological and ecological aspects of nuclear safety and radiation protection	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/egzamin - ustny lub pisemny [SW1] wypowiedź ustna/rozmowa/ dyskusja [SW3] opracowanie tekstowe/ praca pisemna
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	0.0%	5.0%
	not applicable	51.0%	45.0%
	not applicable	51.0%	50.0%
Recommended reading	Basic literature	D. Halliday, R. Resnick, J. Walker, Podstawy fizyki Tom III, IV Wyd. Nauk. PWN, Warszawa 1995. J. Orear, Fizyka, Tom II, Wydawnictwo Naukowo-Techniczne, 1979. A. K. Wróblewski, J. A. Zakrzewski, Wstęp do fizyki tom 2 część 2, PWN, Warszawa 1993. I. V. Sawieliew, Wykłady z fizyki, PWN, Warszaw 1987; E. Koziej, B. Sochoń, Elektrotechnika i elektronika, PWN Warszawa 1987. A. Hennel, W. Szuszkiewicz, Zadania i problemy z fizyki, PWN, 1993. J. Kalisz, M. Massalska, J. M. Massalski, Zbiór zadań z fizyki z rozwiązaniami, PWN, Warszawa 1984. J. Jędrzejewski, W. Kruczek, A. Kujawski, Zbiór zadań z fizyki dla kandydatów na inżynierów, PWN, Warszawa 1984. W. Barański, M. A. Herman. L. Widoski, Zbiór zadań z fizyki. Elektryczność i magnetyzm, PWN, Warszawa 1993.	
	Supplementary literature	not applicable	
	eResources addresses		
	Example issues/ example questions/ tasks being completed	not applicable	
Work placement	Not applicable		

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