



## Subject card

Subject name and code	Electricity and magnetism, PG_00051065						
Field of study	Technical Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
Education level	first-cycle 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	general academic profile	Assessment form			exam		
Conducting unit	Department of Solid State Physics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Waldemar Stampor					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	45.0	0.0	0.0	0.0	75
	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	75		5.0		70.0	150
Subject objectives	The aim of the course is to teach students the basics of electricity and magnetism						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U02] is able to analyse and solve complex and non-standard scientific and technical problems using appropriate analytical, computational, numerical, simulation or experimental methods.	Is able to analyze problems in the field of electricity and magnetism using appropriate analytical methods.	[SU2] Assessment of ability to analyse information
	[K6_U01] demonstrates the ability for lifelong independent learning, including acquiring information from literature, databases and other appropriate sources.	Can learn independently, relying on the recommended literature on the subject and is able to critically obtain information from the Internet and other source materials	[SU2] Assessment of ability to analyse information
	[K6_W01] demonstrates an understanding of the civilisational significance of physics and its applications.	He knows the physical foundations of the phenomena in the field of electromagnetism in the modern world	[SW1] Assessment of factual knowledge
[K6_W02] possesses structured knowledge of the fundamentals of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and molecular physics, solid-state physics, and nuclear and particle physics.	* Student knows properties of electric charge. Student calculates forces between charges. * Student applies Gauss law for electric field calculations. * Student explains the terms of potential and capacitance. * Student calculates forces between charges. * Student explains the terms of current intensity and current density * Student calculates electric circuits parameters. Student describes motion of charges in magnetic field. * Student explains Biot-Savart and Ampere laws. * Student explains Maxwell equations. * Student explains influence of matter on electric and magnetic fields.	[SW1] Assessment of factual knowledge	
Subject contents	<p>Course content – lecture</p> <p><b>ELECTROSTATICS.</b> Electric charge. Electric field strength: Coulomb's law and Gauss's law. Electric potential and the relationship of the potential with the electric field strength. Electric dipole and its behavior in an external electric field. Electric field in matter, conductors and dielectrics. Three electrical vectors: E, D, and P.</p> <p><b>ELECTRIC CURRENT.</b> Electric current intensity and density. Electrical conductivity and Ohm's law. Kirchhoff's laws for electrical circuits.</p> <p><b>MAGNETOSTATICS.</b> Lorentz force. Magnetic induction vector: Gauss's law, Biot-Savart law and Ampere's law. Electrodynamical force. Magnetic dipole and its behavior in an external magnetic field. Magnetic field in matter, types of magnetics. Three electric vectors: E, D and P and three magnetic vectors: B, H and M. Maxwell's equations in electro- and magneto-statics.</p> <p><b>ELECTRODYNAMICS.</b> The phenomenon of electromagnetic induction and Faraday's law. Self-induction. Generalized Faraday's law. Generalized Ampere's law and displacement current. Maxwell's equations.</p> <p>Course content – exercises</p> <ol style="list-style-type: none"> <li>1. Vector calculus using differential operators.</li> <li>2. Determining the electric field intensity: Coulomb's law.</li> <li>3. Determining the electric field intensity: Gauss's law.</li> <li>4. Electric dipole. The behavior of a dipole in an external electric field.</li> <li>5. Kirchhoff's laws for direct current electrical circuits.</li> <li>5. Lorentz force. Motion of a charge in electric and magnetic fields.</li> <li>6. Determining the magnetic induction vector: Biot-Savart law.</li> <li>7. Determining the magnetic induction vector: Ampere's law.</li> <li>8. Magnetic dipole. The behavior of a dipole in an external magnetic field.</li> <li>9. Faraday's law of electromagnetic induction</li> </ol>		
Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	30.0%
	Midterm colloquium	50.0%	40.0%
	Oral exam	50.0%	30.0%

Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. D. Halliday, R. Resnick, J. Walker. Podstawy fizyki tom 3; PWN, Warszawa 2003 lub wydania późniejsze.</li> <li>2. Cz. Bobrowski. Fizyka. Krótki kurs. WNT, Warszawa 2004 lub wydania późniejsze.</li> <li>3. I.W. Sawieliew, Kurs fizyki tom 2, PWN 1989 lub wydania późniejsze.</li> <li>4. Fizyka dla szkół wyższych tom 2. OPENSTAX POLSKA 2018. <a href="https://openstax.org/details/books/fizyka-dla-szkół-wyższych-polska">https://openstax.org/details/books/fizyka-dla-szkół-wyższych-polska</a>.</li> </ol>
	Supplementary literature	D.J. Griffiths. Introduction to electrodynamics. Cambridge University Press 2023.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Electric field strength and magnetic field induction vector.Coulomb's law and Biot-Savart's law.Gauss's law for an electric field and Gauss's law for a magnetic field.Ampere's law for a magnetic field.Maxwell's equations in electro- and magnetostatics.Electric dipole and its behavior in an external electric fieldMagnetic dipole and its behavior in an external magnetic field.Faraday's law for electromagnetic induction and an example of its application.Maxwell's equations in vacuum and material medium.	
Practical activities within the subject	Not applicable	

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