



Subject card

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|---|--|--|---------------------------------|-------------------------------------|---|--|-----|
| Subject name and code | Electrodynamics, PG_00037300 | | | | | | |
| Field of study | Technical Physics | | | | | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | | | | 2027/2028 | |
| Education level | first-cycle studies | Subject group | | | | Optional subject group 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 | |
| Semester of study | 4 | ECTS credits | | | | 5.0 | |
| Learning profile | general academic profile | Assessment form | | | | exam | |
| Conducting unit | Division of Atomic Molecular and Optical Physics -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr hab. inż. Maciej Demianowicz | | | | |
| | Teachers | | | | | | |
| Lesson types | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 30.0 | 30.0 | 0.0 | 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 | | 5.0 | | 60.0 | 125 |
| Subject objectives | Understand the fundamentals of classical electrodynamics. | | | | | | |
| Learning outcomes | Course outcome | Subject outcome | | | Method of verification | | |
| | [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. | The student has structured knowledge of classical electrodynamics and understands its role in the description of electromagnetic fields, electromagnetic interactions, and phenomena occurring in physical systems. The student knows the fundamental laws and equations of electrodynamics, understands their physical consequences, and knows selected mathematical methods, including more advanced analytical techniques, used in the description and analysis of electrodynamic problems. | | | [SW1] Assessment of factual knowledge | | |
| | [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. | The student is able to analyse model problems in electrodynamics and to recognise and apply methods appropriate for studying more complex or non-standard problems. The student is able to identify the laws of electrodynamics adequate for the description of a given problem, select appropriate analytical and computational methods, solve the problem, and then assess the correctness and interpret the significance of the obtained result in the context of the physical problem under consideration. | | | [SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools | | |

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| Subject contents | <p>Course content – lecture</p> <p>Electrostatics in vacuum. Scalar potential. Boundary conditions. Gauss law. Poisson, Laplace equations. Multipole expansion. Electric field in medium. Boundary conditions. Anisotropic dielectrics. Stationary magnetic field in vacuum. Ampere's law. Vector potential, Poisson equation. Biot-Savart law. Continuity equation. Magnetic moment. Magnetostatics in medium. Boundary conditions. Anisotropic magnetics. Law of e-m induction. Maxwell's equations. Potentials of e-m field. Gauging. D'Alambert equation. Energy density and flux. Poynting vector. E-m field momentum. Maxwell stress tensor. E-m waves in homogenous and isotropic media. Monochromatic plane wave. Polarisation. Plane e-m wave in a conducting medium. Reflection and refraction.</p> | | |
| | <p>Course content – exercises</p> <p>Calculation problems including the following topics. Electrostatics in vacuum. Scalar potential. Boundary conditions. Gauss law. Poisson, Laplace equations. Multipole expansion. Electric field in medium. Boundary conditions. Anisotropic dielectrics. Stationary magnetic field in vacuum. Ampere's law. Vector potential, Poisson equation. Biot-Savart law. Continuity equation. Magnetic moment. Magnetostatics in medium. Boundary conditions. Anisotropic magnetics. Law of e-m induction. Maxwell's equations. Potentials of e-m field. Gauging. D'Alambert equation. Energy density and flux. Poynting vector. E-m field momentum. Maxwell stress tensor. E-m waves in homogenous and isotropic media. Monochromatic plane wave. Polarisation. Plane e-m wave in a conducting medium. Reflection and refraction.</p> | | |
| Prerequisites and co-requisites | | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Lecture - written exam (two parts). | 50.0% | 50.0% |
| | Exercise - two tests and one quiz (written) | 50.0% | 50.0% |
| Recommended reading | Basic literature | D.J. Griffiths, Introduction to Electrodynamics Cambridge University Press, 2017 | |
| | Supplementary literature | J.D. Jackson. Classical Electrodynamics, Wiley, 1998 | |
| | eResources addresses | | |
| Example issues/ example questions/ tasks being completed | <p>Lecture.</p> <p>1. Multipole expansion - derivation, significance. 2. Electromagnetic field potentials. 3. Maxwell stress tensor - form, properties, application.</p> <p>Excercise.</p> <p>1. Determining the electric field intensity produced by a uniformly polarized sphere. 2. Determining the magnetic field induction inside a sphere made of a linear magnetic material with a given permeability.</p> | | |
| Practical activites within the subject | Not applicable | | |

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