Fundamentals of Physics III - Electricity and magnetism - course description

General information

Course name	Fundamentals of Physics III - Electricity and magnetism
Course ID	13.2-WF-FizP-FPIII-EM-S16
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2017/2018

Course information

Semester	3
ECTS credits to win	7
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. Wiesław Leoński

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Class	45	3	-	-	Credit with grade

Aim of the course

To present the basic concepts of the classical theory of electromagnetism and the expansion of knowledge possessed by the student in the field. Transfer a knowledge in physics enabling for understanding at basic level the phenomena and processes in the classical electric and magnetic systems.

Prerequisites

Skills in calculus and knowledge of the laws of physics at the high school level, and gained during completed courses.

Scope

- Basic historical background related to discoveries in the field of electromagnetism

- Basic concepts of electricity, discrete nature of the charge, the principle of charge conservation. The concept of an electric field and electric potential - relationships between them. Electric field lines. Potential energy in electric field. Point charge and electric dipoles - their behavior in the electric field. Coulomb's law, electric flux, Gauss's law, gradient of the field.

- Conductors in electric field, charge distributions in conductors, capacitors, capacity. Connecting of capacitors.

- Dielectrics in an electric field, Faraday's experiment, the polarization of dielectrics, electric susceptibility, polarization, electric displacement, isotropic and anisotropic dielectrics.

- Electricity, the concept of stationarity and homogenity of current, current and its density, resistance and resistivity, temperature dependence of resistance, Ohm law, superconductivity, the microscopic description of electric current, Kirchhoff law, electromotive force, energy and its conversion in electric circuits, combining of resistors, compensation circuit, measuring current and voltage, electrical RC circuit.

- Basic concepts related to magnetic field, definition of the vector of magnetic field induction, Lorentz force, magnetic dipole and its behavior in the magnetic field.

- Ampere's law, Biot-Savart law, forces acting on a current-carrying conductor in a magnetic field, ampere unit - its definition.

- Faraday's induction law, Lenz's law, inductance, LR circuit, energy of magnetic field.

- Gauss' law for magnetism, magnetic materials (para-, dia- and ferromagnetic) Curie law, magnetic field vector, magnetization, magnetic permeability.

- Displacement current, symmetry of equations of electromagnetism, the concept of divergence and curl and their relationship to macroscopic physical quantities, integral Maxwell equations and their differential counterparts.

Teaching methods

Classical lectures supported by physical demonstrations, classes.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

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The student has a general knowledge of classical and modern physics, physical measurement methods, which allows for understanding of fundamental physical phenomena of the surrounding world and knows the cause-effect relationships		• an exam - oral, descriptive, test and other	• Lecture
The student understands and can explain physical phenomena and processes using the language of mathematics, can independently reproduce theorems and laws of physics, and selected calculations. Student can create a theoretical model of the phenomenon and find its relationships with the results of measurements		• an exam - oral, descriptive, test and other	• Lecture
The student is able to acquire by oneself his knowledge and develop his skills using a variety of sources (in Polish and foreign language) and modern technology		• an exam - oral, descriptive, test and other	• Lecture
The student recognizes social role of the physics graduate. He especially understands the need for formulating and providing the information and opinions on the achievements of physics to the public. In consequence, he endeavors to provide such information and opinions in a widely understood way		• an exam - oral, descriptive, test and other	• Lecture
The student has a general knowledge of classical and modern physics, physical measurement methods, which allows for understanding of fundamental physical phenomena of the surrounding world and knows the cause-effect relationships		• a quiz	• Class
The student understands and can explain physical phenomena and processes using the language of mathematics, can independently reproduce theorems and laws of physics, and selected calculations. Student can create a theoretical model of the phenomenon and find its relationships with the results of measurements		• a quiz	• Class
The student can analyze and solve physical problems on the basis of his acquired knowledge and information from the available literature sources, online resources (both in Polish and foreign language)		• a quiz	• Class
The student is able to analyze the theoretical and experimental results and formulate appropriate conclusions on their basis		• a quiz	• Class
The student is able to describe chosen physical problem and provide possible solutions		• a quiz	• Class

Assignment conditions

Lecture - obtaining a positive assessment of the final exam (written). In addition, there is the opportunity to prepare and present a study on the given topic or practical task.

Classes - Positive pass all tests.

Before taking the exam a student must gain positive grade during the class.

Total score: a weighted average rating of the exam (70%) and grade from the class (30%).

Recommended reading

[1] D. Halliday, R. Resnick, J. Walker, *Podstawy fizyki, T. III, Elektryczność i magnetyzm*, Wydawnictwo Naukowe PWN, Warszawa (any edition).

[2] Materials prepared and supplied by lecturer (available in electronic form).

Further reading

[1] H. Rawa, *Elektryczność i magnetyzm w technice*, Wydawnictwo Naukowe PWN (any edition).

[2] D. J. Griffiths*, Podstawy elektrodynamiki,* Wydawnictwo Naukowe PWN, (any edition).

Notes

Modified by dr hab. Maria Przybylska, prof. UZ (last modification: 28-11-2017 23:15)