GHENT UNIVERSITY

Course Specifications

From the academic year 2014-2015 up to and including the

Physics 3 (C000248)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0	**Study time 150 h**	**Contact hrs** 62.5 h

Course offerings and teaching methods in academic year 2016-2017

A (semester 2)	lecture	22.5 h
	seminar: coached exercises	12.5 h
	practicum	22.5 h

Lecturers in academic year 2016-2017

Verstraelen, Toon	WE05	lecturer-in-charge

Offered in the following programmes in 2016-2017	crdts	offering
Bachelor of Science in Geology	5	A

Teaching languages

Dutch

Keywords

Electricity, magnetism, electromagnetic oscillations, waves and radition

Position of the course

This course constitutes the third part of general, fundamental physics in the “classical” domain that consists of three major, all-semester courses: I. Mechanics, II. Waves and Optics and Thermal Physics, and III. Electromagnetism (incl. relevant aspects of Modern Physics).
The objective of this third part is to gradually develop the theory of electromagnetism in a “soft” mathematical framework and emanating from the very initial experiments in the domain of electrostatics on the one hand, and those in the area of magnetism on the other hand. This approach finally results in the four fundamental laws of Maxwell that govern all electromagnetic phenomena that are known to date. Numerous relevant examples of these phenomena are presented, discussed and explained, commonly on the basis of elementary mathematics. The paramount importance from the point of view of scientific education and training, is that the student, by this logical and deductive approach, learns how a completely developed domain in natural sciences gradually evolves from basic experiments that lead to fundamental laws. As in Physics 1 and Physics 2, the essential role played by basic calculus in the whole of this process is highlighted. The aim of the lab course, which is an integrated part of Physics 3, is to enlarge the experimental skills of and the critical interpretations of results by the student.

Contents

- Electric charge, conductors, electric force, electric field (laws of Coulomb and Gauss).
- Electric potential (point charges, continuous charge distributions).
- Capacitance and capacitors, dielectrics.
- Current and resistance, circuits (electromotoric force, RC circuit, electric power).
- Magnetic fields, geomagnetic field and storms, magnetic forces on moving charges and currents, discovery of the electron (Thomson´s experiment), Hall effect, mass spectrometer, cyclotron and synchrotron, torque on a current loop – electric motor.
- Magnetic fields due to currents, laws of Biot-Savart and Ampère, solenoid, magnetic dipole moment.
- Induction (laws of Faraday and Lenz) and self-induction, RL circuit, magnetic energy.
- Maxwell´s laws
- Magnetism of matter (electrons, atoms, condensed matter, para-, ferro-, ferri- and

antiferromagnetic ordering.
- Electromagnetic oscillations (LC circuit, RLC circuit, damped and forced oscillations, resonance), alternating currents, power of alternating currents.
- Electromagnetic waves, modern measuring techniques in condensed matter research based on electromagnetic radiation, energy transport, polarisation.
- Some aspects of Modern Physics: wave-particle duality (photoelectric effect, Compton scattering), stimulated emission (the laser), uncertainty principle of Heisenberg, the wave function.

Initial competences

Students taking this course have experienced a sufficient pre-education in the preceding courses Physics 1 and Physics 2. Their knowledge of basic mathematics (trigonometry and calculus) is adequate for the understanding of the mathematical approaches that are involved in the Electromagnetism course.

Final competences

Together with Physics I and Physics II, the third part provides the student with a sound background and scientific thinking and reasoning that will enable her/him to extend her/his studies in the more contemporary physical sciences or in any other fundamentally scientific orientation. Numerous aspects that are touched upon in Physics 3 have important applications in subsequent educations and, possibly, in later scientific research in geology-related fields (mineralogy, soil science, ...). The lab course part prepares the student for the use of more sophisticated equipment used in that research.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, practicum, seminar: coached exercises

Extra information on the teaching methods

Main course (theory): oral sessions based on PowerPoint presentations.
“Worked-out problems and exercises” sessions: oral (on blackboard) with interactive input by student.
Practical sessions: individual use (under supervision and after oral introduction) of instruments to measure physical quantities.

Learning materials and price

Electronic vesrions of printed textbook (syllabus) covering the entire contents of the course (in Dutch) and handouts with instructions regarding the experiments to be conducted in the lab course are available free of charge.
PowerPoint presentations of each given class put at disposal to each student through the Minerva platform.

References

D. Halliday, R. Resnick & J. Walker (2001). Fundamentals of Physics, 6th Ed., Wiley & Sons.
H. Young, R. Freedman (2004). University Physics, 11th Ed., Addison Wesley.

Course content-related study coaching

Through the “worked-out problems and exercises” sessions: development of skills to solve physical problems; through the practical sessions: development of skills to conduct scientific experiments, to critically interpret their results, and to report on these results in a scientific manner.
Individual coaching following the various sessions or by appointment.
Feed back after announcement of the global evaluation results.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, open book examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Skills test, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

Evaluation for theory and problem-solving at the end of semester to probe the students' knowledge and insight and the ability to apply the basic laws of electromagnetism to practical problems.
Once, at the end of semester: written exam to evaluate knowledge of the subjects presented in the course, with emphasis on those aspects that are relevant to future studies in the field. This part of the evaluation counts for 50% of the final score.
Once, at the end of semester: written exam, with open course textbook, to examine the ability of the student to solve physical problems.
Permanent evaluation in the sessions Laboratory Exercises of readiness, experimental skill and ability to critically interpret and report scientific results.

Calculation of the examination mark

Permanent evaluation (15%, is transferable to the second exam period) + periodical evaluation (85%).