GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2022-2023

General Physics (C003607)

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

Credits 6.0	**Study time 165 h**	**Contact hrs**	60.0h

Course offerings and teaching methods in academic year 2022-2023

A (semester 2)	Dutch	Gent	lecture	37.5h
			online lecture	0.0h
			online seminar: coached exercises	0.0h
			seminar: coached exercises	22.5h

Lecturers in academic year 2022-2023

Vrielinck, Henk	WE04	lecturer-in-charge
Filez, Matthias	WE04	co-lecturer

Offered in the following programmes in 2022-2023	**crdts**	**offering**
Bachelor of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

Basic concepts of mechanics, geometrical optics, relativistic kinematics and dynamics, basic concepts of oscillations and waves, electric and magnetic interactions, electromagnetism, Maxwell equations

Position of the course

The aim of this course is, in parallel with and in mutual consultation with the professor of the course of "Theoretical mechanics", the study of the basic laws of physics with the emphasis on electricity and magnetism. Next to the electromagnetic phenomena, a number of topics are treated which are of particular interest for students in mathematics: basics of mechanics from an experimental viewpoint, geometrical optics, elements of oscillations and waves and relativistic mechanics. This course ends with the Maxwell equations.
The content is in agreement with the general objectives of the Bachelor in Mathematics, i.e., an introduction to areas where mathematics is applied and to develop the abstraction ability in dealing with physico-mathematical models.

Contents

Chapter I:Mechanics - Kinematics and Dynamics.
Basic concepts of mechanics from an experimental point of view, position, velocity and acceleration vectors, Newton's laws, units, dimensions, dimension checking
Chapter II: Conservation of linear and angular momentum.
Centre of mass and its motion, conservation of linear momentum, conservation of angular momentum, interaction between particles
Chapter III: Work and energy.
Work, power, kinetic and potential energy, conservative systems, friction forces
Chapter IV:Dynamics of oscillations
Undamped and damped oscillations, forced oscillation
Chapter V: Geometrical optics.
Laws of reflection and refraction, image formation with mirrors and lenses, microscope and telescope, Fermat's principle
Chapter VI: Relative motion.
Relative translation and rotation, Galilei and Lorentz transformation, length

contraction and time dilatation
Chapter VII: Relativistic mechanics.
Classical relativity principle, special relativity principle, linear momentum, force, energy, transformation of energy and linear momentum, transformation of force

Chapter VIII: Electric Interactions.
Charge, Coulomb's law, electric field, quantisation of the electric charge, electrical structure of matter, the atom, electric potential, energy relations in an electric field, electric current, electric dipole, higher order electric multipoles.

Chapter IX: Magnetic Interactions.
Magnetic force on a moving charge, motion of a charge in a magnetic field, magnetic force on a current, magnetic couple for a coil, magnetic field caused by a current through a conducting wire, magnetic field of a narrow, long, and straight conducting string wire, forces exerted between currents, magnetic field of a circular conducting coil, magnetic field of a moving charge (non-relativistic), relation between electromagnetism and the principle of relativity, the electromagnetic field of a moving charge.

Chapter X: Static Electromagnetic Fields.
Flux of a vector field, Gauss' law for the electric field in vacuum, differential form of Gauss' law, electric capacity, condensators, energy of the electric field, electric conductivity, Ohm's law, electromotoric force, Ampère's law for the magnetic field, Ampère's law in differential form, magnetic flux, review of the laws for static fields.

Chapter XI: Time-dependent Elektromagnetic Fields.
Faraday's law, electromagnetic induction caused by the relative motion of a conductor and a magnetic field, electromagnetic induction and the principle of relativity, electric potential and electromagnetic induction, Faraday's law in differential form, selfinduction, energy of the magnetic field, conservation of charge, Maxwell's law, Maxwell's law in differential form, equations of Maxwell.
Chapter XII:Waves.
Wave propagation, mathematical description of a wave, Fourier-analysis of wave motion, Differential equation of wave motion, Doppler effect

Initial competences

Analysis and vector calculus.

Final competences

1 Knowledge of and insight in certain parts of general physics: geometrical optics, classical mechanics, relativistic kinematics and dynamics, oscillations and waves, and electromagnetism.
2 Being able to analyse and model simple physical problems, and to apply mathematical knowledge in this.

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

Online lecture, Lecture, Online seminar: coached exercises, Seminar: coached exercises

Extra information on the teaching methods

Because of COVID19 changes can be made if necessary.
Theory: oral presentation supported by demonstrations, applets, Powerpoint and internet.
Exercises: guided.
ICT: Ufora, Powerpoint.

Learning materials and price

As learning material a syllabus is available. Total cost: about 10 €, distributed by WINA (student organization)

References

"Mechanica", Deel 1, "Fundamentele Natuurkunde", M. Alonso en E.J. Finn, Delta Press, ISBN 90 6674 607 6.
"Elektromagnetisme", Deel 2, "Fundamentele Natuurkunde", M. Alonso en E.J. Finn, Delta Press, ISBN 90 6674 604 1.

Course content-related study coaching

During the theory lessons, fundamental concepts are explained to get insight into this matter. During the exercises, the students' attitudes and aptitudes are developed proper to this course.
The possibility exists to get oral explanations by the teacher, assistant and monitor. Interaction via Ufora occurs frequently.

Assessment moments

end-of-term assessment

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

Open book examination, Written examination with open questions

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

Open book examination, Written examination with open questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

The theoretical part of the exam is "closed book". For the exercises (open book), only the syllabus can be used.
It is checked whether the students master the content of the course, but also (e.g., via exercises) if they have acquired an operational knowledge (cfr. final objective "to be able to acquire new knowledge and to integrate this in already available knowledge and aptitudes). The quality of the written report is evaluated as one of the objectives for the education.

Calculation of the examination mark

Theoretical part (closed book) : 2/3 of the total
Exercises (open book = syllabus) : 1/3 of the total