GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2022-2023

Physics for Citizens (C004225)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 4.0 **Study time 120 h** **Contact hrs** 37.5 h

Course offerings and teaching methods in academic year 2022-2023

A (semester 1)	Dutch	Gent	seminar	7.5 h
			project	5.0 h
			online discussion group	2.5 h
			lecture	22.5 h

Lecturers in academic year 2022-2023

Smet, Philippe	WE04	lecturer-in-charge
Caluwaerts, Steven	WE05	co-lecturer
Dobur, Didar	WE05	co-lecturer
Van Acoleyen, Karel	WE05	co-lecturer

Offered in the following programmes in 2022-2023	**crdts**	**offering**
Bachelor of Arts in Archaeology	4	A
Bachelor of Science in Physics and Astronomy	4	A
Ghent University Elective Courses	4	A
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Teaching languages

Dutch

Keywords

Physics, weather and climate, energy, (science) communication, literature search, ethics, group work

Position of the course

This course unit belongs to the learning pathway "Interdisciplinarity & Broadening" in the Bachelor program Physics and Astronomy.
We live in a rapidly changing world with many challenges that have a pronounced physics component. Knowledge of some basic physical principles is therefore indispensable for any informed citizen - from minister to activist, from CEO to journalist, from doctor to lawyer. The purpose of this (university-wide) elective course is to provide these basic principles and to illustrate their applicability by means of concrete examples and practical situations. No

advanced physics knowledge is therefore required for this course; students will learn precisely how to place current technological and social issues, such as energy and climate, in a scientific context based on a limited number of basic physical principles, and thus to view them with a better-founded view. In more advanced physics lessons, this important step from basic principles to applications is often buried under abstract formulas, as such the course will also be interesting for the more scientifically oriented student. The course is built around four modules: energy, technology, climate and modern physics.

Contents

1) The basic principles of electricity, magnetism, energy conversion, transport and storage are discussed on the basis of concrete examples. Based on efficiency and characteristics of different energy sources (sun, wind, fossil, biomass, geothermal, hydropower, nuclear) you learn to interpret and compose an energy mix. In the case of nuclear energy, the entire life cycle of the nuclear fuel is considered, including the impact of radiation on humans.
2) The electromagnetic spectrum is covered from x-rays to radio waves, in light of contemporary applications in medical imaging to wireless communication. Absorption and emission of radiation as a driving force in the energy balance of the atmosphere. Basic principles of quantum mechanics and the resulting insights into the material building blocks, from atoms and molecules to macroscopic materials. Applications such as lasers, LED, solar panels and transistors. The Second Quantum Revolution: Quantum Cryptography, Quantum Simulation, and Quantum Computing.
3) The impact of climate change and climate mitigation and adaptation policy is felt in almost all aspects of our society (housing, energy, health, agriculture,...). The atmosphere is a complex system and the study of the climate is based on scientific insights that are often based on physics, e.g. conservation laws, thermodynamics, radiation physics, ... Important aspects of climate science and their physical basis are studied (radiation balance, sea level rise, heat islands , dynamics of the atmosphere, climate projections and associated uncertainties, ...). These basic knowledge and skills make it possible to work in a critical manner with information about climate and climate change, such as IPCC reports, climate models, climate projections.
4) With large, complex and / or expensive research infrastructure (CERN, gravitational wave detectors, space missions, ...) physicists continue to search for the building blocks of matter and explore unknown territories. The direct application potential of e.g. neutrinos and gravitational waves seems limited, so why should we invest resources in this? Finally, the state of affairs is outlined in applications such as nuclear fusion or high-temperature superconductivity, which create high expectations but prove difficult to realize.

Initial competences

No specific prior knowledge related to mathematics or physics is required. The student has sufficient knowledge of English.

Final competences

1 To be able to identify and quantify the physical aspects in socially relevant issues related to energy, technology or climate change.
2 To be able to fact check and interpret elements in a debate from a physical framework.
3 To have a good understanding of the relevant physical basic principles and to be able to calculate in orders of magnitude.
4 To be able to work and communicate in a group, towards both peers and the general public.

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, online discussion group, project, seminar

Extra information on the teaching methods

The series of lessons is built up on the basis of lectures and guest lectures, supplemented with guided exercises (orders of magnitude, units, basic laws, ...). Lessons are structured on the basis of reading assignments, peer instruction and position papers.
The application of the basic physical principles to concrete problems is done on the basis of specific assignments, which are carried out individually or in a small group. These assignments are based on current data and issues (energy supply, energy mix of a particular country or region, graphs from IPCC reports,...), whereby the basic assumptions must be interpreted and from which conclusions or recommendations must be drawn. Group discussions in which

students defend or reject a particular statement are conducted during contact moments or via (partly controlled) online discussions on a forum. Finally, the students also look critically at science messages in the media or on social media, with a focus on physical correctness.

Learning materials and price

The slides and the course material are available via Ufora.

References

John M. Wallace & Peter V. Hobss. Atmospheric Science, An Introductory Survey, Academic Press; Richard A. Muller, Physics for Future Presidents: The Science behind the Headlines, WW Norton and Co; David MacKay, Sustainable Energy - Without the hot air (via https://www.withouthotair.com/)

Course content-related study coaching

De lesgevers zijn bereikbaar na afspraak voor verdere toelichting en feedback. Op ufora zijn discussiefora beschikbaar waar vragen gepost kunnen worden.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination

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

Written examination

Examination methods in case of permanent evaluation

Portfolio

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

For the evaluation of this course, a combination is chosen between a written exam, in which, for example, a number of propositions must be assessed from a physical framework, and permanent evaluation. The students keep a portfolio of the different assignments (science communication, interpretation of reports and graphs, substantiated positions, case studies,...). The written exam contains both multiple choice and open questions.

Calculation of the examination mark

Permanent evaluation (paper, participation in online discussion group): 7/20
Written exam: 13/20

Facilities for Working Students

Recordings of lectures will be made available. Possibility of feedback after appointment during and after office hours