GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2025-2026

## Relativity and Electromagnetism (C004216)

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

**Credits 6.0** **Study time 180 h**

**Course offerings and teaching methods in academic year 2025-2026**

| | | | |
|---|---|---|---|
| A (semester 2) | English | Gent | lecture |
| | | | seminar |

**Lecturers in academic year 2025-2026**

| | | |
|---|---|---|
| Ghosh, Archisman | WE05 | lecturer-in-charge |

| **Offered in the following programmes in 2025-2026** | **crdts** | **offering** |
|---|---|---|
| Bachelor of Science in Mathematics | 6 | A |
| Bachelor of Science in Physics and Astronomy | 6 | A |
| Exchange programme Faculty of Sciences (bachelor's level) | 6 | A |
| Preparatory Course Master of Science in Physics and Astronomy | 6 | A |
| Preparatory Course Master of Science in Physics and Astronomy | 6 | A |

**Teaching languages**

English

**Keywords**

Maxwell equations, electromagnetic potentials, electrostatics, magnetostatics, electromagnetic waves, radiation, Lorentz invariance of Maxwell's equations, special theory of relativity.

**Position of the course**

This course unit belongs to the learning pathway "Theoretical physics" in the Bachelor program Physics and Astronomy.
This course offers a theoretical supplement to the treatment of electromagnetism in the basic course of general physics. The mathematical modeling of the theory thereby plays a central role. Students learn how the more descriptive approach to the subject, encountered in the general physics course, can be put into a more general, abstract setting. By means of the appropriate mathematical formalism they are then stimulated to look for solutions of concrete physical problems and they also learn how to interpret these solutions.

**Contents**

- Electrostatics and magnetostatics.
- Basic equations of electromagnetism: Maxwell equations and conservation laws, potentials, gauge transformations, method of retarded potentials.
- Electromagnetic waves.
- Fields and radiation of moving charges.
- Lorentz invariance of Maxwell's equations and the special theory of relativity.
- Covariant formulation of electrodynamics.

**Initial competences**

For the electromagnetism course it suffices that the students have a basic knowledge of analysis, vector analysis and of the phenomenological aspects of electromagnetism as presented in the general physics course.

**Final competences**

1 The students are imparted some insight into the general methodology of classical electromagnetism, Lorentz invariance and the special theory of

relativity.

2 They acquire the necessary basic knowledge that is needed for a more advanced study of the subjects on the one hand, and that will enable them to tackle the applications of electromagnetism and relativity encountered in other branches of theoretical physics, on the other hand.

3 As far as the mathematical formalism is concerned, they acquire some familiarity with the use of certain specific concepts and techniques, such as: Fourier transforms, distributions, Green functions and Legendre polynomials.

**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**

Seminar, Lecture

**Extra information on the teaching methods**

Exercises: guided tutorials.

**Study material**

Type: Handbook

Name: David J. Griffiths: Introduction to Electrodynamics (5th edition), Cambridge University Press (2024)
Indicative price: € 74
Optional: no
Language : English
ISBN : 978-1-00939-775-9
Additional information: The student should have access to either a hardcopy or an electronic copy of the textbook. Any of the recent editions (5th, 4th, or 3rd) should be fine. The price quoted above is from Standaard Boekhandel for the hardcopy of the most recent edition. The student may be able to get access to the course material at a lower price for older editions or for online versions. Any complementary material will be available as a pdf via the e-learning platform.

**References**

Richard P. Feynman, Robert B. Leighton, Matthew Sands: The Feynman Lectures on Physics, Vol. II (revised 50th anniverary edition), Basic Books (2011)

John D. Jackson: Classical Electrodynamics (3rd edition), John Wiley & Sons (1999)

**Course content-related study coaching**

Students may always consult the lecturer and assisting staff when they have questions regarding the theory and/or exercises. The use of e-mail and of other electronic means (such as a learning platform) will be encouraged, but the personal contact between lecturer and student will always play an important role.

**Assessment moments**

end-of-term and continuous assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

**Examination methods in case of permanent assessment**

Assignment

**Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible in modified form

**Extra information on the examination methods**

- Theory: assignments and written exam (students may thereby use a list of basic formulas - the main goal is to test their insight into the material).
- Exercises: assignments and written exam (students may thereby use a list of basic formulas - the main goal is to test their insight into the material).

**Calculation of the examination mark**

Non-periodical evaluation -- assignments (40%)

- 20% Theory
- 20% Exercises

Periodical examination -- end-term exam (60%)

- 30% Theory
- 30% Exercises

Students will need to independently pass the non-periodical assessment as well as end-of-term exam in order to pass the course.