

## Electromagnetism I (E022110)

**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 2023-2024**

A (semester 1)

Dutch

Gent

seminar

**Lecturers in academic year 2023-2024**

Vande Ginste, Dries

TW05

lecturer-in-charge

**Offered in the following programmes in 2023-2024**

[Bachelor of Science in Engineering\(main subject Biomedical Engineering\)](#)

6

A

[Bachelor of Science in Engineering\(main subject Engineering Physics\)](#)

6

A

[Bridging Programme Master of Science in Engineering Physics](#)

6

A

[Preparatory Course Master of Science in Biomedical Engineering](#)

6

A

**Teaching languages**

Dutch

**Keywords**

Maxwell's equations, plane waves, multiconductor lines and waveguides, 2D phenomena, Green's function.

**Position of the course**

Providing insight in electromagnetic wave phenomena. Providing a number of basic electromagnetic principles and theorems. One- and two-dimensional analytic solutions of Maxwell's equations. Basic concepts and study of closed electromagnetic waveguides and transmission line representation. Transmission lines: reflection, loading, input impedance, Smith chart, pulses. To introduce some numerical solutions of Maxwell's equations and to use one of these techniques through a project exercise.

**Contents**

- General 3D problems: Potentials, reciprocity, constitutive equations, ...
- Plane waves
- Two-dimensional phenomena
- Electromagnetic waveguides and multiconductor lines
- Transmission lines: load impedance, input impedance, reflection, Smith chart, standing waves, pulse reflection
- Numerical electromagnetism: Numerical project

**Initial competences**

Physics II

**Final competences**

- 1 To be able to describe, understand and discuss wave propagation in free space and in waveguides.
- 2 To understand and to be able to obtain Green's functions for general free space current sources and for 2D problems.
- 3 To understand, calculate and determine voltage and current behaviour on transmission lines.
- 4 To be able to program a numerical technique as applied to a "simple" wave problem.

**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**

Group work, Seminar, Lecture, Independent work

**Extra information on the teaching methods**

The course consists of lectures about theory and exercises, without making a strict, traditional distinction between them. All lectures are seminars which require interaction with and input from the students. During the semester a numerical problem must be tackled and programmed in Python. The results of this project are written down in a report.

**Learning materials and price**

course notes: hardcopy via VTK (approx. 10 EUR) / electronic version via Ufora for free

**References**

- geen

**Course content-related study coaching**

Questions can be asked, e.g., after each lecture, via email, or by making an appointment

**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, Written assessment

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

Written assessment with open-ended questions, Written assessment

**Examination methods in case of permanent assessment**

Assignment

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

examination during the second examination period is possible

**Extra information on the examination methods**

During examination period: written closed-book exam - theory; written open-book exam - exercises

During semester: graded project reports + code.

**Calculation of the examination mark**

The project counts for 20% of the total score. The project score can be carried over to second examination period but if wanted, the student can submit a new project. The exam counts for 80% of the total score. The total score will be a weighted average of the two partial scores. For the project (during the semester) and for both aspects of the exam (during the examination period), i.e. the theory part and the exercise part, a minimum score of 40% must be obtained. When the score of one of these three parts is less than 40%, the maximum total score cannot exceed 8/20.