

Mathematical Methods in Physics (C001887)

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 6.0 Study time 180 h Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	Dutch	Gent	teaching method	hours
			seminar: coached exercises	30.0 h
			lecture	30.0 h
			online seminar: coached exercises	0.0 h
			online lecture	0.0 h

Lecturers in academic year 2020-2021

Vandersickel, Nele WE05 lecturer-in-charge

Offered in the following programmes in 2020-2021

programme	crdts	offering
Bachelor of Science in Physics and Astronomy	6	A

Teaching languages

Dutch

Keywords

Mathematical physics, special functions, partial differential equations (PDE).

Position of the course

The aim of this course is to learn to use in a practical manner the mathematical techniques and methods useful in physics, not covered by previous courses. At the end of the course, the student should be able to translate a physical problem in mathematical form (PDE, boundary value problem) and solve the problem analytically in an efficient way.

Contents

Vector analysis. Curvilinear coordinates. Complex analysis. Ordinary second order differential equations in the complex plane. Method of Frobenius. Sturm-Liouville problem. Bessel functions. Legendre functions. Application to practical problems. Laplace transform.

Initial competences

Basic knowledge of mathematical analysis and linear algebra is sufficient.

Final competences

- 1 The student is acquainted with elementary mathematical techniques in physics, such as vector calculus, complex analysis, integral transforms, Hilbert spaces and generalized Fourier series. He/She understands the physical implications of several mathematical properties.
- 2 The student is able to grasp the essence of a physical problem and to convert it to a mathematical problem, e.g. initial or boundary-value problem, including appropriate boundary conditions.
- 3 The student can recognize when common mathematical methods in physics are suitable to apply, and apply them independently.
- 4 The student is aware of the approximations and limitations which come with physical models of reality (e.g. assumption of linearity), leading them to critically interpret their results.

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, seminar: coached exercises, online lecture, online seminar: coached exercises

Extra information on the teaching methods

New mathematical methods are introduced during theory lessons (45% of total time). These techniques are then applied and thoroughly assimilated during guided exercise sessions, with emphasis on concrete physical problems.

Learning materials and price

- Handbook
G. Arfken, H.J. Weber, F.E. Harris: Mathematical Methods for Physicists - A Comprehensive Guide, Academic Press, Waltham (2013) (Estimated cost: €100)

References

- G. Arfken, H.J. Weber, F.E. Harris: Mathematical Methods for Physicists - A Comprehensive Guide, Academic Press, Waltham (2013).
- P. Morse, H. Feshbach: Methods of Theoretical Physics, McGraw-Hill, (1953)

Course content-related study coaching

The lectures and exercise classes are meant to be interactive sessions. In case of more questions, the teacher and assisting personnel can be contacted anytime during the semester. Additional notes and explanation with the exercises are uploaded on Ufora.

Evaluation methods

end-of-term evaluation

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

Written examination with open questions

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

Written examination with open questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

The exam consists of three or four concrete problems to be solved which are of the same sort as those solved during the exercise sessions.

Calculation of the examination mark

100 % exam exercises