GHENT UNIVERSITY

Course Specifications

From the academic year 2024-2025 up to and including the academic year

Differential Equations (I002428)

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

Credits 5.0 **Study time 150 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 1)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2025-2026

Schelfaut, An	LA26	staff member
Vanhaelewyn, Gauthier	LA26	staff member
Stock, Michiel	LA26	lecturer-in-charge

Offered in the following programmes in 2025-2026	**crdts**	**offering**
Bachelor of Science in Bioscience Engineering	5	A

Teaching languages

Dutch

Keywords

Ordinary and partial differential equations, analytical methods, numerical methods, Python, stability

Position of the course

This course bridges the gap between the courses 'Calculus' and 'Modelling and Simulation of Biosystems' and provides a basis for most of the engineering courses. The student gets familiar with systems of (non-) linear differential equations that play an important role in the description of physical, biological and chemical phenomena, develops a certain routine in the use of some elementary analytical solution techniques, gains insight in the integral transformation of Laplace and gets acquainted with frequently used numerical solution methods.

Contents

Part I: Analytical methods

1. First-order differential equations
2. Second- and higher-order linear differential equations
3. Series solutions of linear differential equations
4. Second-order partial differential equations
5. Systems of first-order linear differential equations
6. Systems of first-order non-linear differential equations
7. Laplace transforms

Part II: Numerical methods

1. Direction fields and equilibrium points
2. Euler's method
3. Runge-Kutta methods
4. Partial differential equations
5. Systems of differential equations
6. Higher order differential equations

Initial competences

Differential Equations builds on certain learning outcomes of course units 'Calculus, 'Linear algebra' , and 'Scientific Computing'; or the learning outcomes have been achieved differently.

Final competences

1 Recognize various types of differential equations.
2 Apply elementary analytical solution techniques routinely.
3 Implement and apply numerical solution methods for (partial) differential equations.
4 Perform correct and critical interpretations of the generated Python-output.
5 Use Sympy/Wolfram Alpha to solve differential equations analytically.

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, Independent work

Study material

Type: Handbook

Name: Chapters from Kohler and Johnson
Indicative price: € 25
Optional: no

References

1. Coleman, M.P.: An introduction to partial differential equations with MATLAB, Chapman & Hall, 2005.
2. Duffy, D.: Advanced Engineering Mathematics, CRC Press, 1998.
3. Fausett, L.: Applied Numerical Analysis using MATLAB, Prentice Hall, 1999.
4. King, A., J. Billingham & S. Otto: Differential Equations, Cambridge, 2003.
5. Shampine, L., I. Gladwel & S. Thompson: Solving ODEs with MATLAB, Cambridge, 2003.

Course content-related study coaching

1. The lecturer announces office hours for questions related to the theory.
2. The teaching assistants are available for questions related to the exercises and the practical computer sessions.
3. Interactive support via Ufora.

Assessment moments

end-of-term 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

Possibilities of retake in case of permanent assessment

not applicable

Calculation of the examination mark

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.