

## Calculus (C003774)

**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 2024-2025

A (semester 2)

Dutch

Gent

seminar

lecture

### Lecturers in academic year 2024-2025

Vindas Diaz, Jasson

WE16

lecturer-in-charge

### Offered in the following programmes in 2024-2025

[Bachelor of Science in Computer Science](#)

**crdts**

**offering**

6

A

### Teaching languages

Dutch

### Keywords

Continuity, derivatives, convergence, sequences and series, integrals.

### Position of the course

It is widely recognized that calculus has a great value in the education of a scientist and a computer scientist in particular. The aim of this course is twofold: educational and technical. The educational facet is realized through precision, generality and insight. At the same time mathematical analysis has to introduce a lot of practical techniques or skills (such as calculation of limits, differentiation, convergence of sequences and series, integration) that are used in other courses.

### Contents

- The course Calculus starts with a revision of some basic principles: set theory, intervals, lower and upper bounds, minima and maxima.
- Next, (real) sequences and series are introduced, and limits of sequences are studied using the notion of convergence.
- Functions are introduced, along with the important notion of continuity. The Intermediate Value Theorem is studied and is applied to the general notion of inverse functions. Extremal values and the Extremal Value Theorem are discussed.
- Limits of functions are introduced, followed by arithmetic for continuity and limits of real functions.
- Some important classes of functions are discussed: rational and irrational functions, trigonometric and cyclometric functions, exponential functions and logarithms.
- We recall the process of differentiation for a real mapping dependent on a real variable. Moreover the chain rule and the calculus for derivatives are given as well as the fundamental mean value theorems. We discuss de l'Hospital's rule for limits involving indeterminate forms.
- We discuss the definite, the indefinite integral and primitives of real functions. We give some basic techniques for the calculation of integrals. Further on we treat improper integrals and provide an application to volumes.
- The course ends with some criteria for convergence of real sequences and real series, and with an introduction to power series and Taylor approximation.

### Initial competences

The student knows elementary logic notions provided in the course 'Reasoning, abstracting and formulating', such as logic connectors and quantification. The

student is able to use elementary algebraical techniques (calculating with real numbers, solving equations).

#### **Final competences**

- 1 The student has insight in the behaviour of elementary functions (polynomial functions, rational functions, irrational functions, exponential functions, logarithmic functions, trigonometric functions, cyclometric functions).
- 2 The student is able to apply the techniques for the investigation of functions (determine the domain, continuity, limits, derivatives) in practical cases. The student is able to apply de l'Hospital's rule.
- 3 The student is able to investigate the convergence of sequences and series and can deal with the Taylor approximation of a function.
- 4 The student is able to calculate definite, indefinite and improper integrals. The student is able to determine the primitives of a real function.

#### **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

#### **Study material**

Type: Handbook

Name: Calculus Deconstructed (Zbigniew Nitecki)

Indicative price: € 40

Optional: no

#### **References**

#### **Course content-related study coaching**

Students have different opportunities to ask questions, both individually and in group: before and after the lessons, during lessons, after an appointment (appointments can be made orally or electronically) or between students (using the electronic teaching platform Ufora).

#### **Assessment moments**

end-of-term assessment

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

Written assessment with multiple-choice questions, Written assessment with open-ended questions

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

Written assessment with multiple-choice questions, Written assessment with open-ended questions

#### **Examination methods in case of permanent assessment**

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

not applicable

#### **Extra information on the examination methods**

The examination is in written form and "open book".

#### **Calculation of the examination mark**

100% written exam