GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Fundaments of Programming Languages (C003241)

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

Credits 6.0 **Study time 165 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 1)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2025-2026

Scholliers, Christophe	WE02	lecturer-in-charge

Offered in the following programmes in 2025-2026	**crdts**	**offering**
Master of Science in Teaching in Science and Technology(main subject Computer Science)	6	A
Master of Science in Teaching in Science and Technology(main subject Mathematics)	6	A
Master of Science in Computer Science	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

programming languages, type systems, operational semantics, lambda calculus

Position of the course

This course introduces the student to the formal study of programming language and the mathematical techniques used for that purpose.

Contents

The courses covers in a formal manner

- syntax
- operational semantics
- type systems
- program analysis based on hoare logic
- the most important properties of syntax, semantics, type systems and related proof methods, including
  - type preservation
  - progress
  - Curry-Howard isomorphism
  - logical relations
  - ...

The study is performed on the basis of the simply typed lambda-calculus and various extensions, such as

- primitive types
- tuples
- records
- sum types
- polymorphism
- ...

Not all topis are covered every year.

Initial competences

Experience with the practical use of a programming language, e.g. by means of the Programming/Programming 1 course.

Knowledge of first order logic and basic mathematical proof techniques such as induction.

Final competences

1 To formalize informal statements about programming languages.
2 To prove properites of programming languges.
3 To use the most important concepts of type systems and hoare logic creatively in new applications.
4 To appreciate the formal treatment of programming languages.
5 Give proofs in the COQ proof assistant

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

alternating lectures and excercise sessions

Study material

Type: Software

Name: Software'
Indicative price: Free or paid by faculty
Optional: no
Additional information: Software Foundations online course, Benjamin C. Pierce, free website, free

References

- Hennessy, M. (1990). The semantics of programming languages. Wiley. http://www.scss.tcd.ie/Matthew.Hennessy/slexternal/reading.php
- Winskel, G. (1993). The formal semantics of programming languages. MIT Press.
- Carl Gunter. Semantics of Programming Languages. MIT Press, 1992. (ISBN 0-262-07143-6)
- Robert Harper. Practical Foundations for Programming Languages. Working draft, 2006. (online, as PDF)
- Shriram Krishnamurthi. Programming Languages: Application and Interpretation. (online, as PDF)
- Mitchell, John C.. Foundations for Programming Languages.
- John C. Reynolds. Theories of Programming Languages. Cambridge University Press, 1998. (ISBN 0-521-59414-6)
- Kenneth Slonneger and Barry L. Kurtz. Formal Syntax and Semantics of Programming Languages. Addison-Wesley.
- Robert D. Tennent (1991). Semantics of Programming Languages. Prentice-Hall.
- H. Nielson and F. Nielson (1993) Semantics with Applications. A formal Introduction. Wiley

Course content-related study coaching

interactive support on the electronic teaching system Ufora (forums, e-mail), appointments for personal support

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

Oral assessment, Presentation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Calculation of the examination mark

project assignments: 40%
exam: 60%
When a student obtains a grade less than 10/20 for either the theory or the project, the total end grade will be maximally the highest failing grade 9/20.