Department of Mathematics
(incl. Math. Statistics)

Stockholm University

Syllabus

for course at advanced level

Type theory
Typteori

7.5 Higher Education Credits
7.5 ECTS credits

Course code:	MM8036
Valid from:	Autumn 2013
Date of approval:	2013-05-20
Department	Department of Mathematics (incl. Math. Statistics)
Main field:	Mathematics/Applied Mathematics
Specialisation:	A1F - Second cycle, has second-cycle course/s as entry requirements

Decision

This syllabus was approved by the Board of the Faculty of Science at Stockholm University 2013-05-20.

Prerequisites and special admittance requirements

Admission to the course requires knowledge equivalent to at least 90 credits in mathematics, including the course Logic 7.5 credits (MM7008). English B/English 6 or equivalent.

Course structure

Examination code	Name	Higher Education Credits
HELA	Type theory	7.5

Course content

The course provides an introduction to type theory with simple and dependent types, how it can be used to represent logical systems and proofs, and how proofs give rise to computable functions. The final part of the course covers applications of type theory. The following topics are covered:
Type theory: lambda calculus, contexts, forms of judgement, simple types, inductive types. Operational semantics: confluence and normalization. The Curry-Howard isomorphism. Martin-Löf type theory: dependent types, induction and elimination rules, identity types, universes. The Brouwer-Heyting-Kolmogorov interpretation of logic. Meaning explanations. Semantics of dependent types. Explicit substitution. Category theoretical models. One or more of the following areas of application of type theory are covered: homotopy theory, models for (constructive) set theory and proof assistants.

Learning outcomes

After taking the course, students are expected to:
* be able to define basic concepts in type theory and lambda calculus and derive their simplest properties,
* be able to state and prove basic theorems in type theory and lambda calculus and their semantics,
* be able to use methods in type theory to formalize and give constructive proofs of mathematical theorems.

Education

Instruction consists of lectures and exercises.

Forms of examination

a. The course is examined as follows: Knowledge assessment takes the form of written assignments as well as written and oral exams.

b. Grades are assigned according to a seven-point goal-related grading scale:
A = Excellent
B = Very Good
C = Good
D = Satisfactory
E = Sufficient
Fx = Fail (more work required before credit can be awarded)
F = Total fail

c. The grading criteria will be distributed at the beginning of the course.

d. To be awarded a pass, a minimum of grade E is required.

e. Students who fail an ordinary examination are entitled to sit additional examinations as long as the course is offered. There is no restriction on the number of examinations. Examinations also include other obligatory elements of the course. Students who have passed an examination may not resit it in order to achieve a higher grade. Students who have failed on two occasions are entitled to request the appointment of a different examiner for the next examination. Any such request must be made to the departmental board. The course has at least two examinations for each academic year in the years in which instruction is provided. Intervening years include at least one examination.

f. There is no facility to improve grade Fx up to a pass grade in this course.

Interim

Students may request that the examination be conducted in accordance with this course plan even after it has ceased to be valid. However, this may not take place more than three times over a two year period after course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course plan.

Misc

This course is offered as part of the Master's Programme in Mathematics and as a separate course.

Required reading

Course literature is decided by the departmental board and described thereafter in an appendix to the course plan.