



## Course syllabus

Faculty of Technology  
Department of Mathematical Education

1MAÄ09 Matematik II - inriktning mot arbete i årskurs 7-9, 15  
högskolepoäng  
Mathematics II - for lower secondary school teachers, 15 credits

**Main field of study**  
Mathematics

**Subject Group**  
Mathematics

**Level of classification**  
First Level

**Progression**  
G1F

**Date of Ratification**  
Approved by Faculty of Technology 2013-09-02  
The course syllabus is valid from spring semester 2014

**Prerequisites**  
NO VALUE DEFINED

### Objectives

#### Common expected learning outcomes

After completing the course students will be able to:

- identify and analyze aspects of teaching profession in relation to the subject matter and subject matter didactics
- discuss, analyze and make didactic standpoints related to the activities that the education prepares for
- develop advanced mathematical skills in the areas covered in the course
- use the mathematical content covered in the course in an educationally conscious way in relation to the areas that the education prepares for.

Otherwise, the expected learning outcomes are valid for each module.

#### Module 1 Calculus I

After completing this module students will be able to:

- perform calculations of limits, derivative and integral
- interpret and use the basic functions and equations
- sketch graphs and solve the extreme value problems
- solve basic types of differential equations

- use the derivative and integral for problem solving
- describe the definitions of and deduce relationships between key concepts in the course and be able to use these relationships when solving problems
- deduce simple relationship for limits, derivatives and integrals in calculus
- interpret, communicate and argue using representational forms of mathematics.

## **Module 2. Mathematics education for lower and upper secondary school II, 7.5 credits**

After completing this module the students will be able to:

- relate knowledge of mathematics subject and the idea of historical development to learning and teaching mathematics in lower secondary schools
- explain how teachers' mathematical knowledge for teaching interacts in the teacher's planning and implementation of teaching
- use mathematical abilities and competencies to describe the mathematical content in lower secondary school
- show how the variation of working forms and working methods as well as variation of representations can support the conceptual development and the development of problem solving ability
- describe the research in mathematics education concerning conceptual development and problem solving.

### **Content**

The course deepens the student's own mathematical knowledge while the mathematics education knowledge develops on the basis of the mathematics education portfolio that the students bring with them from the previous course.

Their own subject knowledge with respect to upper secondary school mathematics is related to learning and teaching of mathematics. Field studies are carried out in upper secondary schools to give students an insight into the position of mathematics in schools, the teaching profession and practice as well as of teaching mathematics form and content.

### **Module 1. Calculus I**

Course Content

- Limits and Continuity: limit definition, rules for calculation, Squeeze Theorem, standard limits, the number “e”
- Derivative and function study: definition of the derivative, rules for calculation, the derivatives of elementary functions, mean-value theorem, extreme value problems, curve sketching, asymptotes
- Integrals: Antiderivatives, the definition of the definite integral, the fundamental theorem of calculus, the mean-value theorem for integrals, integration by parts, the method of substitution, integrals of rational functions
- Differential equations: linear and separable DE of first order, linear DE of second order with constant coefficients

### **Module 2 Mathematics education for lower and upper secondary school II**

As the basis for a problematisation of the relationship between subject knowledge and teaching the student is given an orientation on how mathematical knowledge for teaching can be categorized. The student's own math knowledge for upper secondary school mathematics - in arithmetic, geometry, algebra, functions, probability and statistics, derivatives and integrals as well complex numbers and differential equations - is related to the theoretical framework of abilities/competencies that form the basis of upper secondary school documents. The course highlights how the variation of working forms and working methods as well as variation of representation forms can be used in planning and implementation of mathematics teaching in upper secondary schools. The

mathematical abilities conceptualization and problem solving are anchored theoretically by the way the scientific articles are dealt with.

### Type of Instruction

Teaching consists of lectures, group exercises and mandatory seminars. Part of the program may be online.

### Examination

The course is assessed with the grades Fail (U), Pass (G) or Pass with Distinction (VG).

The course is examined partial through active participation in seminars, method meeting and presentations, partial through written and oral presentations of individual and group assignments, and partial through written examination/home exam. Some of examinations are practical moments (field studies) that the student implements and presents. Teaching arrangements requires mandatory attendance.

### Course Evaluation

After completing the course, is a course evaluation compiled and written feedback to the students. The statement recognized for the current institutional bodies and for the relevant Programme Board, and filed by the course coordinator department.

### Required Reading and Additional Study Material

#### Required Reading

Module 1

Robert A. Adams. Calculus – A Complete course, AddisonWesley Educational Publishers, latest edition.

Module 2. Mathematics education for lower and upper secondary school II

Bergsten, Christer; Häggström, Johan & Lindberg, Lisbeth. (1997). Algebra för alla. Nämnaren Tema, NCM. ISBN 91-88450-08-2

Freudenthal, H. (1991). Revisiting Mathematics Education – The China Lectures. Springer Verlag. ISBN10 0792312996. (Section 1.1, 19 p)

Grevholm, Barbro (red.). (2001). Matematikdidaktik – ett nordiskt perspektiv. Lund: Studentlitteratur. (app 150 pages). ISBN: 91-44018-35-5

Hansen, Hans Christian, Skott, Jeppe & Jess, Kristine (2009). Matematik för lärare Ypsilon volume 1 & 2, Gleerups förlag. ISBN13 9789140668134 & ISBN13 9789140667861

National Research Council (2001). Adding it up: Helping Children learn mathematics. In: Jeremy Kilpatrick, Jane Swafford & Bradford Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of BEhavioral and Social Sciences and Education. Washington, DC: National Academy Press. (app 100 pages). ISBN13 9780309069953

Niss, Mogens (2003). Mathematical competencies and the learning of mathematics: the Danish KOM project. Proceeding of the 3rd Mediterranean Conference on Mathematics Education – Athens, Hellas 3-5 January 2003, 116-124. (available online)

Niss, Mogens & Højgaard Jensen, Tomas (Red.) (2002). Kompetencer og matematiklæring. Ideer og inspiration til udvikling af matematikundervisning i Danmark. Uddannelsesstyrelsens temahæfteserie nr. 18-2002. Udervisningsministeriet 2002. (app 70 pages)

Nilsson, Per. (2008). Elever resonerar om sannolikhet. I G. Brandell m.fl. (red.), Matematikdidaktiska frågor - resultat från en forskarskola (p. 106-119). Göteborg: NCM och SMDF. ISBN 9789185143115

Schoenfeld, Allan (1992). Learning to think mathematically: problem solving,

metacognition, and sense making in mathematics. I Grouws Douglas (ed.) Handbook of research on mathematics teaching and learning (p. 334-370). New York: Macmillan. ISBN13 9780029223819

Skolverket. Kursplan och betygskriterier för ämnet matematik. Stockholm: Skolverket. [www.skolverket.se/sb/d/165/a/8906](http://www.skolverket.se/sb/d/165/a/8906)

Sollervall, Håkan (2007). Tal och de fyra räknesätten. Lund: Studentlitteratur. ISBN: 9789144045276. (app 172 pages)

Stadler, Erika (2009). Stadiövergången mellan gymnasiet och universitetet. Matematik och lärande ur ett studerandeperspektiv. Acta Wexionensia No 195/2009. ISBN: 9789176366905. (app 30 pages)

Van den Heuvel-Panhuizen, Marja. (2000). Mathematics education in the Netherlands: A guided tour. Freudenthal Institute Cd-rom for ICME9. Utrecht: Utrecht University. (32 p) <http://www.fi.uu.nl/en/rme/TOURdef+ref.pdf>

Material provided by the department, about 200 pages.

#### Didactic literature

Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare Ypsilon band 1 och band 2, Gleerups förlag, latest edition.