Linnæus University

Course syllabus

Board of Education Science

School of Computer Science, Physics and Mathematics

1MAÄ03 Matematik II - inriktning mot arbete i årskurs 7-9, 30 högskolepoäng

1MAÄ03 Mathematics II – for lower secondary school teachers, 30 credits

Main field of study
Mathematics

Subject Group
Mathematics

Level of classification
First Level

Progression
G1F

Date of Ratification
Approved by School of Computer Science, Physics and Mathematics 2011-10-11
The course syllabus is valid from spring semester 2012

Prerequisites
For admission to the course the student has to be approved for at least half of the course Mathematics I – for lower secondary school teachers, 30 credits or equivalent.

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. Development of mathematics, 7.5 credits

After completing the course students will be able to:

- describe the role of mathematics for different applications in a historical perspective
- interpret and use different cultures mathematical methods for calculations and problem solving
- interpret and communicate about the development of mathematics in a specific field

Module 2. Geometry and algebra, 7.5 credits

After completing the course students will be able to:

- describe, in broad terms, the structure of Euclid's Elements, and Axiom Systems in general
- solving problems with lines and circles
- describe the interaction between geometry and algebra (classical and modern)
- compute tangents and normals to conic sections, and solve some more complex problems in this area
- explain the basics of projective geometry, and solving some problems in this area
- produce symmetry groups of plane figures
- describe the three classic "unsolvable" construction problems
- compare different approaches to a geometric problem

Module 3. Mathematics education for lower secondary school, grades 7- 9, Part 2, 7.5 credits

After completing the course students will be able to:

- relate knowledge of mathematics subject and the idea of historical development to learning and teaching mathematics for grades 7-9
- 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 grades 7-9
- show how the variation of working forms and working methods as well as variation of representation forms can support the conceptual development and the development of problem solving ability
- describe the research in mathematics education concerning conceptualization and problem solving.

Module 4. Probability and statistics, 7.5 credits

After completing the course students will be able to:

- describe the basic concepts of probability theory, especially the concepts of Kolmogorov's axioms as well as the term "independent"
- describe the difference between uncorrelated and independent stochastic variables
- understand the difference between the different concepts of convergence in probability theory

- use stochastic methods of calculation
- describe, and use the law of large numbers
- understand the proof for the central limit theorem and use this theorem
- analyse stochastic problem areas with respect to different distributions
- understand and use the basic concepts of statistics, which are: point estimation, interval estimation and hypothesis testing
- interpret, communicate and argue with probability theory forms of representation, especially to solve tasks in small groups and be able to describe these in the class.

Content
Overall Content
The course deepens the student's own subject knowledge in geometry, algebra, probability and statistics. In addition, the student gains knowledge of the historical idea of mathematics development, mathematical abilities as well as competencies and their importance for learning and teaching in mathematics. Further, the student develops didactical knowledge concerning concept formation and problem solving. During the course, field studies are conducted at lower secondary school to give students an insight into mathematics instruction form and content.

Module 1. Development of mathematics, 7.5 credits

- an overview of mathematics development from antiquity to the medieval
- a more detailed review of developments in the Babylonian, Egyptian, Greek, Chinese, Indian, Arabic and medieval European mathematics
- a review of mathematical interaction with some applications, such as trade, land surveying and natural science
- a deepening linked to the mathematical developments in any specific area.

Module 2. Geometry and algebra, 7.5 credits

- Measurement of distances, areas and volumes.
- Euclid's Elements. Axiomatic System.
- Theorems of triangles and circles.
- Constructions with compass and ruler.
- Problem solving.
- Geometry and algebra - an interaction.
- Symmetry groups of plane figures.
- Conic sections, mainly treated in coordinate form.
- Projective geometry - foundations. Desargues theorem. Pascal and Brianchons theorems. Pappus theorem.
- Three classic "unsolvable construction problems", as well as something about the (algebraic) number fields.

Module 3. Mathematics education for lower secondary school, grades 7- 9, Part 2, 7.5 credits

As 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 mathematical knowledge for lower secondary school mathematics, grades 7- 9, in arithmetic, geometry, algebra, functions, probability and statistics is related to the theoretical framework of abilities/competencies that form the basis for

lower secondary school documents. The course highlights how the variation of working forms and working methods as well as variation of representation's forms can be used in planning and implementation of mathematics teaching. The mathematical abilities, conceptualization and problem-solving are anchored theoretically by the treatment of scientific articles.

Module 4. Probability and statistics, 7.5 credits

- universal simple space and events,
- probability, concept of conditional probability and independent events,
- discrete and continuous random distributions,
- single and multi-dimensional random variables, moments, probability and moment generating functions, conditional expected values simultaneous and marginal distributions,
- probability theory, basic convergence concepts,
- law of large numbers,
- central limit theorem,
- point estimation, interval estimation and hypothesis testing.

Type of Instruction
Teaching consists of lectures, group exercises and mandatory seminars. Part of the program may be network-based.

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. Development of mathematics
Jan Thompson, Matematiken i historien, Studentlitteratur, latest edition. 300 (478) pages.
Jan Thompson, Matematiken i historien, Övningsbok, Studentlitteratur, latest edition. 124 (124) pages.

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

Module 2. Geometry and Algebra
Anders Tengstrand. Åtta kapitel om geometri. Studentlitteratur, senaste upplagan. 240 (311) pages.

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

Module 3. Mathematics education for lower secondary school, grades 7- 9, Part 2
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 on the internet)
Niss, Mogens & Højgaard Jensen, Tomas (Red.) (2002). Kompetencer og
matematiklœring. Ideer og inspiration til udvikling af matematikundervisning i
Danmark. Uddannelsesstyrelsens temahœfteserie 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
Sollervall, Håkan (2007). Tal och de fyra räknesätten. Lund: Studentlitteratur. ISBN:
9789144045276. (app 172 pages).
Stadler, Erika (2009). Stadieövergången 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 s) http://www.fi.uu.nl/en/rme/TOURdef+ref.pdf
Material provided by the department, about 200 pages.

Module 4. Probability and statistics
Bertsekas, Dimitri P. Tsitsiklis, John N., Introduction to Probability, Athena Scientific,
Belmont, Massechusetts, latest edition. 544 pages.

Didactic literature
Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare

Ypsilon volume 1 och volume 2, Gleerups förlag, latest edition.