LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Endimensionell analys
Calculus in One Variable

FMAA01, 15 credits, G1 (First Cycle)

Valid for: 2018/19
Decided by: PLED F/Pi
Date of Decision: 2018-03-23

General Information

Main field: Technology.
Compulsory for: BME1, M1, MD1
Language of instruction: The course will be given in Swedish

Aim

The aim of the course is to give a basic introduction to calculus in one variable. Particular emphasis is put on the role that the subject plays in applications in different areas of technology, in order to give the future engineer a good foundation for further studies in mathematics as well as in other subjects. The aim as also to develop the student's ability to solve problems, to assimilate mathematical text and to communicate mathematics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- within the framework of the course with confidence be able to handle elementary functions of one variable, including limits, derivatives and integrals of them.
- be able to set up and solve some types of linear and separable differential equations that are important in the applications.
- be familiar with the logical structure of mathematics, in the way it appears e.g. in plane geometry.
- be able to give a general account of and illustrate the meaning of mathematical concepts in calculus in one variable that are used to construct and study mathematical models in the applications.
- be able to account for the contents of definitions, theorems and proofs.

Competences and skills
For a passing grade the student must

- be able to demonstrate a good algebraic computational ability and without difficulties be able to calculate with complex numbers.
- in the context of problem solving be able to demonstrate an ability to independently choose and use mathematical concepts and methods in one-dimensional analysis, and to construct and analyse simple mathematical models.
- in the context of problem solving be able to integrate knowledge from different parts of the course.
- be able to demonstrate an ability to explain mathematical reasoning in a structured and logically clear way.

Contents

Part 1. The number concept. Calculation with fractions. Inequalities. Square roots. Curves and equations of degree 2. Geometry in the plane. Analytic geometry. The circle, ellipse, hyperbola. Arithmetic and geometric sums. The binomial theorem. The modulus of a number. Trigonometry. Powers and logarithms. The concept of a function. The properties of the elementary functions: graphs, formulas. Sequences of numbers.

Part 2. Limits with applications: asymptotes, the number *e*, series. Continuous functions. Derivatives: definition and properties, applications. Derivatives of the elementary functions. Properties of differentiable functions: the mean value theorem with applications. Curve sketching. Local extrema. Optimization. Some simple mathematical models. Complex numbers and polynomials. The Taylor and Maclaurin formulae. Expansions of the elementary functions. Understanding the remainder term. Applications of Maclaurin expansions. Problem solving within the above areas.

Part 3. The concept of primitive function. Simple integration methods: partial integration and change of variable. Partial fractions. Definition of the Riemann integral. Riemann sums. Geometric and other applications of integrals. Improper integrals. Differential equations of first order: linear and with separable variables. Linear differential equations. Solution of homogeneous and certain inhomogeneous equations. Applications. Problem solving within the above areas.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written test on each subcourse, comprising theory and problem solving. The final grade is the integer part of a weighted mean (weights 1,1,2) of the three grades on the subcourses. Computational ability tests. Some oral and written assignments. ONLY STUDENTS WHO PASSED THE TESTS OF COMPUTATIONAL ABILITY AND THE FIRST ORAL ASSIGNMENT MAY PARTICIPATE IN THE FIRST WRITTEN TEST. ONLY STUDENTS WHO PASSED THE SECOND ORAL ASSIGNMENT MAY PARTICIPATE IN THE THIRD WRITTEN TEST.

The examiner, in consultation with Disability Support Services, may deviate from the

regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0108. **Name:** Part A1.
Credits: 5. **Grading scale:** UG. **Assessment:** Written test comprising theory and problem solving. Computational ability tests must be passed before the examination. One assignment (oral and in writing) must be passed before the examination. **Contents:** See above, part 1.

Code: 0208. **Name:** Part A2.
Credits: 5. **Grading scale:** UG. **Assessment:** Written test comprising theory and problem solving. One assignment (oral and in writing) must be passed before the examination. **Contents:** See above, part 2.

Code: 0308. **Name:** Part A3.
Credits: 5. **Grading scale:** UG. **Assessment:** Written test comprising theory and problem solving. **Contents:** The whole course, but with emphasis on part 3 above.

Code: 0408. **Name:** Computational Ability Test 1.
Credits: 0. **Grading scale:** UG.

Code: 0508. **Name:** Assignment 1.
Credits: 0. **Grading scale:** UG.

Code: 0608. **Name:** Assignment 2.
Credits: 0. **Grading scale:** UG.

Code: 0708. **Name:** Computational Ability Test 2.
Credits: 0. **Grading scale:** UG.

Admission

The number of participants is limited to: No
The course overlaps following course/s: FMA410, FMA415, FMA645, FMAA05

Reading list

- Diehl, S: Inledande geometri för högskolestudier. Studentlitteratur, 2015. Chapters P,T, A.
- Övningar i Inledande geometri för högskolestudier. Studentlitteratur, 2015, ISBN: 9789144067865.
- Månsson, J. och Nordbeck, P.: Endimensionell analys. Studentlitteratur, 2011, ISBN: 9789144056104.
- Övningar i endimensionell analys. Studentlitteratur, 2018, ISBN: 9789144127187.

Contact and other information

Course coordinator: Studierektor Anders Holst, Studierektor@math.lth.se
Course administrator: Studerandeexpeditionen, expedition@math.lth.se
Course homepage: http://www.maths.lth.se/utbildning/matematiklth/
Further information: The course Calculus in one variable is taught and examined in two versions, A(=FMAA01) and B(=FMAA05) respectively, depending on the student's program. The goals are the same. The present course description is version A. Before the written retake exams there it will be possible to retake the tests computational ability and the oral assignments.