Course syllabus

Endimensionell analys
Calculus in One Variable

FMAA01, 15 credits, G1 (First Cycle)

Valid for: 2019/20
Decided by: PLED F/Pi
Date of Decision: 2019-03-26

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

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 obtained from a weighted mean (weights 1,1,2) of the three grades on the
subcourses, by rounding to the closest integer. In case the decimal part of the mean value
is 0.5, it is rounded to the grade obtained on two subcourses, e.g. the results 3, 3 and 4
give the mean value 3.5 and the final grade 3 whereas the results 4, 4 and 3 give the mean
value 3.5 and the final grade 4. 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
Credits: 5. Grading scale: TH. 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.
Credits: 5. Grading scale: TH. 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.
Credits: 5. Grading scale: TH. Assessment: Written test comprising theory and problem solving. Contents:
The whole course, but with emphasis on part 3 above.
Code: 0419. Name: Computational Ability Test 1.
Credits: 0. Grading scale: UG.
Credits: 0. Grading scale: UG.
Credits: 0. Grading scale: UG.
Code: 0719. 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.
  9789144056104.

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 it will be possible to retake the tests of computational
ability and the oral assignments.