SF1673 Analysis in one variable 7.5 credits

Analys i en variabel

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SF1673 valid from Autumn 2016

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Basic and specific requirements for engineering program.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course students should for a passing grade be able to

- Show understanding of the concept of function, including domain and range, composite and inverse functions.
- know the properties and definitions of the elementary functions: polynomials, rational functions, power functions, exponential and logarithmic functions, trigonometric functions and their inverses, the arcus functions. Know their derivatives including how to derive the derivatives.
- know the definition of continuity and limit and use these to calculate limits in simple cases.
- know the limit laws including how to derive these, as well as calculate limits using these laws, Taylor's formula and L'Hospital's rule.
- know the definition of derivative and be able to derive general rules of differentiation and apply them.
- be able to formulate, and derive, the mean value theorem (of differential calculation), its consequences for determining where functions increase and decrease, respectively. Be able to use this in problem solving.
- be able to formulate and use the theorem of intermediate values and the existence of a largest and smallest value of a continuous function restricted to a closed and bounded interval.
- use the derivative to characterize local and global extreme points, perform curve sketching, as well as derive inequalities.
- be able to find primitive functions of simple elementary functions, including general methods for this, for example variable substitution and partial integration and their derivation.
- be able to formulate, and derive, the fundamental theorem of integral calculus and how it is used to calculate integrals using primitive functions.
- be able to determine whether certain simple generalized integrals and series converge or diverge.
- be able to use integrals to derive formulas for arc length, area and volume, as well as be able to use these formulas.
- be able to solve simple first order differential equations, specifically linear and separable differential equations.
- be able to solve second order linear differential equations with constant coefficients, including initial and similar problems, as well as determine particular solution in simple cases.
- be able to formulate Taylor's formula and determine Taylor polynomials as well as estimate the remainder term in simple cases.
- read, interpret and comprehend mathematical texts, and be able to express oneself mathematically correct in calculations and proofs.
- be able to interpret mathematical concepts and theorems intuitively and graphically, e.g. by sketching graphs, explaining the geometric meaning of an argument, or drawing a simple sketch that illustrates the idea behind a proof.

- show understanding of the structure of mathematical theory, e.g. the role of theorems, definitions and proofs and how these help us to perform calculations. Show understanding of the mathematical (axiomatic) method by analyzing theorems, creating counter examples and being able to determine what amounts to a proof and what is an informal argument.

For higher grades, the student in addition should be able to:

- be able to solve more difficult, more complex problems and show more insight into the theory and concepts.
- show a good understanding of the theory of continuous functions and real numbers. Specifically, the role of the completeness axiom can be explained and used to show existence of limits, intermediate values, etc.
- be able to generalize and adapt the methods to partly new situations.

Course contents

This course contains the theory of derivatives and integrals, and this is the essence of the course. But in order to understand derivatives and integrals, one needs to have a good understanding of the concept of function and for limits. The concept of limit is the most central in the whole mathematical analysis. In addition to functions, limits, derivatives and integrals, we will also discuss continuity and some applications on these concepts. Primarily Taylor polynomials, i.e. how to approximate a differentiable function with a polynomial - which is a much easier function. And differential equations - i.e. equations containing derivatives.

The course is also a gateway to more advanced mathematics. This means that you are likely to change the perception of what mathematics is. You will focus on the analysis of concepts and on theorems, definitions and proofs. The goal is that you, after completing the course, will have a different picture of what mathematics is and what mathematical knowledge means and gain a much deeper understanding of the mathematics you learned in high school.

Course literature

The literature is published on the course webpage no later than four weeks before the course starts.

Examination

- TEN1 - Final Exam, 7.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Written exam (TEN1; 7.5 hp).

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.