SF1674 Multivariable Calculus 7.5 credits

Flervariabelanalys

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

Establishment

Course syllabus for SF1674 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 knowledge of linear algebra and calculus in one variable as presented in

- SF1672 Linear Algebra
- SF1673 Analysis in one variable

Language of instruction

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

Intended learning outcomes

After completing this course with a passing grade the student should be able to

- Be able to explain the concept of functions of several variables, including the domain and range, composite and inverse functions, level curves and surfaces, and in simple cases, the concepts of open set, closed set, bounded set and boundary of a set.
- Be able to differentiate, and know that the order in which you differentiate is does not matter when the derivatives are continuous. To use the chain rule and transform simple differential expressions to new coordinates.
- Be able to use the second order derivatives to characterize critical points, mainly in two dimensions.
- Be able to determine the minimum and maximum values for continuous functions on closed and bounded domains. In simple cases use the Lagrange's method to optimize functions under constraints.
- Be able to determine the equation for a tangent plane. Be able to determine the gradient of a function and know its interpretation as normal to tangent lines and planes, respectively. To calculate directional derivatives.
- Be able to use linear approximation and Taylor's formula, mainly to order two and in two dimensions.
- Be able to determine the curvature of curves in two and three dimensions.
- Be able to describe how the double integrals is introduced as the limit of Riemann sums. To calculate double integrals, and in simple cases triple integrals, by repeated integration. This includes determining the limits of integration in the successive integrations.
- Be able to use multiple integrals in applications, e.g., for determining volume and area.
- Be able to calculate line integrals in two and three dimensions. To calculate surface integrals in three dimensions. In simple cases, use Green's formula and the divergence theorem.
- Be able to change path in line integrals and in simple cases determine whether a potential function exists, and, where appropriate, determine the potential.

For higher grade the student must also:

- In general solve more difficult, more complex problems and show greater understanding of the theory and concepts, mainly the theory of continuous functions.
- Be able to define limits and continuity and prove that a given function is continuous. Knowing the difference between limits and continuity of one and higher dimensions.
- Be able to define differentiability and provide criteria for it.
- Use Taylor's formula of higher order and for the three variables, including the second order derivative test at critical points.
- Determine derivatives by implicit differentiation of equations.
- Be able to describe curves and surfaces orientation, the independence of path of line integrals, the existence of potential function, and phenomena that occur at singular fields and potentials.

- Be able to formulate and use Stokes' theorem.

Course contents

Functions of several variables. Fundamental topological concepts in R^n. Differentiability and linear approximation of mappings.

Partial derivatives, differentials, gradient.

The chain rule in general form. The implicit function theorem.

Extreme value problems with and without constraints. Multiple integrals, coordinate changes, geometric applications. Elementary Vector Analysis: Line integrals and surface integrals, Gauss, Green's and Stokes' formulas.

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.

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

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.