Calculus in Several Variables

Programme course

8 credits

Flervariabelanalys

TATA43

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical
Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study

Mathematics, Applied Mathematics

Course level

First cycle

Advancement level

G1X

Course offered for

- Biomedical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Physics, Bachelor´s Programme
- Mathematics, Bachelor´s Programme
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites

Linear algebra and Calculus

Intended learning outcomes

The course will give basic proficiency in several-variable calculus required for subsequent studies. After completing this course, students should be able to

- define and explain basic notions from topology and concepts as function, limit, continuity, partial derivative, (local) extremal point, and multiple integral
- cite, explain and use central theorems such as the max-min existence theorem, differentiability implies existence of partial derivatives, the chain rule, Taylor's formula, the characterization of stationary points, the theorem on local maxima and minima with constraints, the implicit function theorem, and the theorem on change of variables in multiple integrals
- investigate limits, continuity, differentiability, and use the chain rule for transforming and solving partial differential equations
- explain the geometric significance of directional derivatives and gradients, and determine equations for tangent lines and tangent planes
- investigate local and global maxima and minima, with or without constraints
- explain the behavior of an implicitly given function, for example by Taylor expansion through implicit differentiation
- calculate multiple integrals by means of iterated integration and using various changes of variables, notably linear, plane polar and spherical
- investigate convergence of improper multiple integrals and calculate their values
- verify that results and partial results are correct or reasonable

Course content

The space R^n. Fundamental notions from topology. Functions from R^n to R^p. Function graphs, level curves and level surfaces. Limit and continuity. Partial derivatives. Differentiability and differential. The chain rule. Gradient, normal, tangent and tangent plane. Directional derivative. Taylor's formula.
Local and global extrema. Extremal problems with constraints by means of linearly dependent gradients. Implicitly defined functions and implicit differentiation. Multiple integrals. Iterated integration. Change of variables. Area, volume, mass and center of mass. Improper multiple integrals.

Teaching and working methods

Lectures and lessons

Examination

TEN1	Written examination	8 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

Supplementary courses: Vector analysis, Complex analysis, Fourier analysis

Department

Matematiska institutionen

Director of Studies or equivalent

Jesper Thorén

Examiner

Vladimir Tkatjev

Course website and other links

http://www.mai.liu.se/kurser/index-amne-tm.html

Education components

Preliminary scheduled hours: 76 h
Recommended self-study hours: 137 h

Course literature

Additional literature

Books

Persson, A, Böiers, L-C, (2005) *Analys i flera variabler* Studentlitteratur, Lund

Compendia

Other

Problemsamling utgiven av matematiska institutionen

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.