Course syllabus

Variationskalkyl
Calculus of Variations

FMAN25, 7,5 credits, A (Second Cycle)

Valid for: 2016/17
Decided by: Education Board B
Date of Decision: 2016-03-29

General Information

Elective for: D4, E4, F4, F4-bg, Pi4-bs, Pi4-fm, Pi4-bg, Pi4-bem
Language of instruction: The course will be given in English on demand

Aim

The aim of the course is to present the basic theory for, and applications of, the calculus of variations, i.e., optimization problems for "functions of functions". A classical example is the isoperimetric problem, to find which closed curve of a given length encloses maximal area. Many physical laws can be formulated as variational principles, i.e. the law of refraction. The calculus of variations is also a corner stone in classical mechanics, and has many other technological applications e.g. in systems theory and optimal control.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

be able to explain the basic parts of the theory in the context of an oral examination.

Competences and skills

For a passing grade the student must

- be able to demonstrate an ability to identify problems which can be modelled with the concepts introduced.
- be able to integrate methods and views from the different parts of the course in order to solve problems and answer questions within the framework of the course.
- in writing and orally, with clear logic and proper terminology be able to explain the
solution to a mathematical problem within the course.

Contents

- Variational problems without and with constraints. Euler’s equations with and without constraints. Legendre’s, Jacobi’s and Weierstrass’ necessary conditions for a local minimum.
- Hilbert’s integral and Weierstrass’ sufficient conditions for a strong local minimum.
- Hamilton’s principle and Hamilton’s equations. Lagrange’s och Mayer’s problems.

Examination details

Grading scale: TH
Assessment: Written assignments and oral exam.

Admission

Required prior knowledge: FMA430 Calculus in Several Variables.
The number of participants is limited to: No
The course overlaps following course/s: FMA200

Reading list


Contact and other information

Course coordinator: Anders Holst, studierektor@math.lth.se
Teacher: Niels Christian Overgaard, nco@maths.lth.se
Course homepage: http://www.maths.lth.se/course/varkal/