FSF3710 Advanced Topics in Differentiability and Integrebility 7.5 credits

Avancerade ämnen i differentierbarhet och integrerbarhet

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 FSF3710 valid from Spring 2015

Grading scale

Education cycle

Third cycle

Specific prerequisites

This course is open for PhD students. It is desirable to have a solid background in mathematical analysis (such as SF2713 Foundations of Analysis) and measure theory

(such as SF2743 Advanced Real Analysis). Some basic understanding of POE and Sobolev spaces is also desirable.

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 the student should:

- Have a good understanding of a variety of different subjects in mathematical analysis. The subject areas studied can, to a certain extent be influenced by the students own researchareas. But the understanding should include real function theory, singular integrals, convexity, de Giorgi- Nash-moset theory, convergence properties of Fourier series.
- Be able to independently read, understand and present advanced mathematics.
- Be able to discuss and synthesize mathematics.
- Be able to put the above mentioned subjects in perspective and have some insight of their possible applications.

Course contents

Mathematical analysis is a rich and varied subject with many different techniques and methods. There is hardly any branch of mathematics that has not been influenced by the powerful methods of analysis. This course will cover a large number of these techniques. We will, in particular, cover real function theory (Sobolev, Lipschitz and BY-spaces), singular integrals (Calderon-Zygmund theory), convexity (Alexandrov's Theorem), some advanced techniques in partial differential equations (such as de Giorgi- Nash-Moser theory) and some convergence properties of Fourier series. After the course the student will have a good understanding of a variety of advanced topics in analysis.

Disposition

The course leaders will start the course with a few preparatory lectures where the subject area is presented and possible areas will be presented. The course participants will then choose a topic to present during a seminar -each course participant must present their topic at a seminar. The course leaders will make sure that the core of modem mathematical analysis is represented in the course and that the course is coherent and at an acceptable level of difficulty. Each student will be responsible for their seminar with the support of the course leaders. The course leaders will also be responsible for a number of seminars (depending on the number of course participants) to assure that the course has the desired breath and difficulty.

During the course the participants will be given homework assignments and the course will conclude with an oral exam.

Course literature

The course literature will be depend on the topics presented and will be agreed upon between the course participants and the course leaders. Individual chapters form the following books might be used:

L Caffarelli, X Cabre -Fully nonlinear elliptic equations

R Courant, D Hilbert- Methods of Mathematical Physics, Volume 1

M G. Crandall, H Ishii, P-L- Lions user's guide to viscosity solutions of second order partial differential equations

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L.C. Evans -Partial Differential Equations

L C Evans, R F Gariepy- Measure theory and fme properties of functions

D Gilbarg, N Trudinger- Second order partial differential equations

E Giusti- Direct Methods in the Calculus of Variations

E Di Nezza, G Palatucci, E Valdinoci- Hitchhiker's guide to the fractional Sabalev spaces

J Maly, W Ziemer Fine regularity properties for solutions of elliptic PDEs

E Stein - Harmonic analysis

E Stein - Singular Integrals and Differentiability Properties of Functions

L Tartar- The General Theory of Homogenization

W Ziemer- Weakly differentiable functions Sobolev spaces and functions of bounded variation

Examination

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.

- Presentation of one topic during a seminar.
- Suggest home assignments for the fellow students.
- Active participation in seminars.
- Oral exam at the end of the course.

Other requirements for final grade

Oral exam.

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.