Lund University

Faculty of Science

NUMN19, Numerical Analysis: Numerical Approximation, 7.5 credits

Numerisk analys: Numerisk approximation, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2017-06-26 to be valid from 2017-06-26, spring semester 2018.

General Information

The course is an elective course for second-cycle studies for a Master of Science in Mathematics.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding

On completion of the course, the student shall be able to:

- motivate and exemplify the need for approximations of functions, both from the theoretical and the computational point of view,
- describe how to find good approximations with respect to different norms, in particular the 1-, 2- and supremum-norms, and account for the difficulties in each of the three latter cases,
- account for the relation between the topology of the approximation space and the existence and uniqueness of best approximations,
- formulate the main theorems of approximation theory, especially the characterisation theorems and the Weierstrass theorem, and outline their proofs.

Competence and skills

On completion of the course, the student shall be able to:

- identify the relevant approximation algorithm for a given situation, and write a computer program which implements it,
- present solutions and numerical results for problems such as the above ones in written and oral form,
- with adequate terminology, in a logical and well-structured manner, explain the design of the numerical methods and algorithms developed in the course.

Course content

- *The approximation problem:* Norms, approximation spaces, the Weierstrass theorem.
- *Theory of best approximation in Euclidean spaces:* Existence, uniqueness, characterisation theorems, duals.
- *Construction of best approximations:* Orthogonality, Chebyshev polynomials, Haar spaces, the exchange algorithm.

Course design

The teaching consists of lectures, weekly computational projects and theoretical assignments.

Assessment

Homework (computational projects and theoretical assignments) and an oral exam.

If required for a student with permanent disabilities to be granted an equivalent examination option compared to a student without disabilities, the examiner may, after consultation with the university's Disability Support Services, decide about an alternative form of examination for the student concerned.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
The final grade is based on the grades on the homework and on the oral examination. The responsible teacher will announce how these are weighted during the current course round at the start of the course.

Entry requirements

For admission to the course, general entry requirements and knowledge equivalent to the courses MATB21 Analysis in Several Variables 1, 7.5 credits, MATB22 Linear Algebra 2, 7.5 credits, MATB23 Analysis in Several Variables 2, 7.5 credits, NUMA01 Computational Programming with Python, 7.5 credits, and NUMA41 Numerical Analysis, basic course, 7.5 credits, are required.

Further information

The course may not be included in a higher education qualification together with NUM121 Numerical analysis: Numerics 1, 5p, nor with NUMA12 Numerical Approximation, 7.5 credits.

Subcourses in NUMN19, Numerical Analysis: Numerical Approximation

Applies from V18

1701 Assignments, 0,0 hp
Grading scale: Fail, Pass

1702 Oral Examination, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction