

SYLLABUS

Principles of Mathematical Analysis 7.5 credits M7026M

Analysens grunder

Course syllabus admitted: Autumn 2023 Sp 1 - Present

**DECISION DATE
2022-02-14**

Principles of Mathematical Analysis 7.5 credits M7026M

Analysens grunder

Second cycle, M7026M

Education level

Second cycle

Grade scale

U G VG *

Subject

Matematik

Subject group (SCB)

Mathematics

Entry requirements

To profit by this course, the student is expected to know how to use fundamental tools for mathematical analysis, primarily induction, limits of functions and integrals. More precisely, corresponding to what is taught for engineering applications in courses like Differential Calculus (M0047M) as well as the integration part of the course Linear Algebra and Calculus (M0048M) or equivalent .

Selection

The selection is based on 30-285 credits

Course Aim

After finishing the course, the student shall be able to:

Knowledge and understanding

- Explain the central concepts, definitions and theorems in the Course contents and how they are related.
- Give illustrating examples for the introduced concepts and theorems.

Skills and abilities

- Prove central theorems introduced in the course.
(Except for some particularly complicated proofs, where it is enough to be able to read the proofs and explain how they combine different mathematical concepts and results.)
- Explain a mathematical line of argument in a structured and logically coherent way.
- Apply introduced concepts and theorems to problem solving. Some typical examples:
 - Decide if a given set is countable.
 - Confirm the limit of a function or sequence using the definition of limit.
 - Compute a given limit of a function using l'Hospital's rule.
 - Decide if a given function is Riemann integrable and explain why.
 - Decide if a given series converges and explain why.
 - Compute the limit of certain series.
 - Decide if a given sequence of functions converges pointwise and/or uniformly.

Assessment and attitude

- Future math teachers finishing the course shall be able to discuss and critically examine elementary descriptions of the theory in corresponding courses at upper-secondary school and university level.
- Future math teachers finishing the course shall be able to give useful supervision for unusually talented pupils who need guidance and help outside the ordinary curriculum. (This also requires pedagogic skills that are not examined in this course, but in other courses and in "pedagogic strips" for the Master programme in Secondary Education.)

Contents

The course covers the following topics:

- Number systems.
- Harmonisc, geometric and arithmetiv means.
- Countable and uncountable sets.
- Sequences and limits of sequences and functions.
- Topology of the real numbers for av reella tal for showing known properties of functions, such as mean value theorems.
- Uniform continuity.
- Lipschitz continuity.
- Differentiable functions, mean value theorems and l'Hospital's rules.
- Riemann integrals, definition and properties.
- Discontinuous functions that are integrerbble under special conditions (for example functions with jump discontinuities).
- Lebesgue measure 0 and the Lebesgue theorem about the set of Riemann integrable functions.
- Infinite sums (series) of real numbers and functions. Convergence criteria and construction of continuous functions that are nowhere differentiable.
- Uniform convergence.

Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

The teaching currently consists of lectures and homework problems for the students. In the future, this can be extended with for example problem solving classes or seminars where the students are more active, but that would first require making recorded lectures for setting free time for such activities.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Written exam with grading scale U, G, VG.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Remarks

The course is compulsory for the Master programme in Secondary Education (for future math teachers in the upper-secondary school), but also chosen by interested students from other programmes (especially engineering programmes).

Important parts of the underlying theory is left out in the courses mentioned under "Entry requirements" above, and the chosen courses also omit important topics like series och l'Hospital's rule.

This course fills those gaps, which is both an important foundation for continued math studies, as well as for the goals under "Assessment and attitude".

Course offered by

Department of Engineering Sciences and Mathematics

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0001	Written exam	U G VG *	7.5	Mandatory	A14	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Niklas Lehto, Programme Director 2022-02-14

Syllabus established

by Mats Näsström 2014-02-14