Submodule	**TM abbreviation**
Mathematics 2 (Analysis)	MA2

Responsible person	Faculty
Prof. Dr. Filippo Riccio	Computer Science and Mathematics
Teacher / Lecturer	Frequency of supply
Prof. Dr. Filippo Riccio	Only in the summer semester

Teaching form
Seminar teaching (4 SWS) with exercises (2 SWS)

Semester of study according to curriculum	Teaching scope [SWS or UE]	Teaching language	Work effort [ECTS credits]
2.	6	English	7

Time commitment:

Classroom study	Self-study
90 hours	120 hours

Study and examination performance
Written exam: 90 minutes

Contents
• Sequences and series (including convergence terms - convergence criteria for sequences and series - function series). • Continuity (e.g. continuity concepts - intermediate value theorem) • Differential calculus (e.g. differentiation rules - mean value theorem of differential calculus - extreme values) • Integral Calculus (e.g. Riemann's Integral - Mean Value Theorem of Integral Calculus - Main Theorem of Differential and Integral Calculus - Integration Rules) • Multidimensional analysis (e.g. functions in several variables - limits and continuity - differentiability, total and partial derivative - extreme values)
Learning objectives: Professional competence

- determine the behaviour of a given sequence of numbers (2).
- examine number sequences for the applicability of the various convergence criteria (3) and determine the convergence behaviour (2).
- explain the definition of elementary functions using power series (1).
- describe the concept of the derivative (1) and explain the meaning of the derivative (2).
- calculate the derivatives of given functions (2).
- analyse the behaviour of functions with the help of the central theorems of calculus (e.g. intermediate value theorem or mean value theorem) (3).
- solve application problems for differential calculus (2) and examine the solution for plausibility (3).
- describe the definition of the Riemann integral (1) and explain the meaning of the Riemann integral in different fields of application (2).
- to carry out the elementary integration methods (e.g. partial integration and integration by substitution) (2).
- to recognise the connections between differential calculus and integral calculus (2).
- solve application problems for integral calculus (2) and examine the result for plausibility (3).
- describe the concept of partial differentiability (1).
- explain the geometric meaning of gradients (2) and use them in application tasks (2).
- name methods for calculating local and global extrema (1).
- analyse (3) and solve (3) application tasks for calculating extreme values.

Learning objectives: Personal competence

- discuss subject matter in learning groups (2).
- analyse the arguments of others (3).
- evaluate the learning process in learning groups (3).
- name different learning methods (1).
- formulate exactly what they did not understand (2).
- to work out new contents in self-study (2).
- evaluate the personal benefit of different learning methods (3).
- analyse their own learning progress and learning needs (3).
- organise their learning process (time management) independently (2).
- present mathematical relationships in their own words (2).
- recognise their level of knowledge and learning needs (2).

Teaching media

Blackboard, projector, mathematical software

Literature

- Fonda, A.: A Modern Introduction to Mathematical Analysis, 2023, Birkhäuser
- Magnus, R.: Fundamental Mathematical Analysis, 2020, Springer
- Ovchinnikov, S.: Real Analysis: Foundation, 2021, Springer
- Abbott, S.: Understanding analysis, 2016, Springer

The numbers in brackets indicate the levels to be reached: 1 - know, - 2can, - 3understand and apply