Module title		SM Code
Mathematics 1		**MA1**
Module lecturer	**Faculty**	
Prof. Dr. Ralf Lenz	Computer Science and Mathematics	
Module language	**Number of SWS / WSH**	**ETCS credits**
English	6 SWS / WSH	6
Teaching format		
Seminar-based teaching with approx. 20% practical component		

Semester according to the study plan	
1st semester	
Attendance/classroom hours	**Additional independent study**
84 hours	Preparation and follow-up work: 67 hours Exam preparation: 29 hours
Type of examination / Requirements for the award of the credit points	
Written exam: 90 minutes	

Teaching content

Fundamentals
- Sets, sequences, series, functions

Single-variable differential calculus
- Derivative of elementary functions
- Differentiation rules
- Curve sketching

Single-variable integral calculus
- Area and definite integral
- Antiderivative and indefinite integral
- Integration methods
- Improper integrals

Real vector spaces
- The concept of a vector
- Linear relationships
- Magnitude, distance, dot product, cross product

Matrices and determinants
- Matrix arithmetic
- Square matrices
- Rank, determinant
- Eigenvalues and eigenvectors

Systems of linear equations
- Row echelon form
- Solution sets

Learning objective: Professional competence

After successfully completing this module, students will be able to

- explain fundamental concepts, definitions, and examples of univariate real analysis, e.g., limits, sequences, derivatives, integrals, and linear algebra, e.g., vectors, matrices, systems of linear equations (1)
- provide an overview of essential rules and methods of univariate real analysis, e.g., differentiation, integration, and linear algebra, e.g., matrix calculations, determinant calculations, eigenvalue calculations, and for solving systems of linear equations (1)
- determine the convergence/divergence of simple sequences of real numbers (2)
- reliably determine the derivative of univariate real functions (2)
- correctly use important integration methods for univariate real functions (2)
- correctly perform matrix, rank, and determinant calculations (2)
- determine eigenvalues and eigenvectors in small dimensions (2)
- reliably calculate the solution sets of systems of linear equations (2)
- investigate the limit and continuity behavior of univariate real functions (3)
- analyze the behavior of univariate real functions using differential calculus (3)
- geometrically analyze univariate real functions using integral calculus (3)
- effectively apply matrix calculus and matrix parameters to linear relationships (3)
- analyze and interpret solution sets of systems of linear equations (3)

Literature

Recommended reading

- J. Stewart, Calculus. Cengage Learning Services, 2014
- G. Strang, Linear Algebra. Springer, 1998
- Y. Stry and R. Schwenkert, Mathematik kompakt. Springer, 2012
- T. Westermann, Mathematik für Ingenieure. Springer, 2011

The numbers in brackets indicate the levels to be achieved: (1)-know | (2)-can | (3)-understand and apply