Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Computational Mathematics
Code der Lehrveranstaltung	76268
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	MATH-05/A
Sprache	Italienisch
Studiengang	Bachelor in Informatik
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Bruno Carpentieri, Bruno.Carpentieri@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38064
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	3
KP	6
Vorlesungsstunden	40
Laboratoriumsstunden	20
Stunden für individuelles Studium	90
Vorgesehene Sprechzeiten	18
Inhaltsangabe	· Introduction to Computational Modelling and Finite Precision Computation · Matrix Factorization Methods: LU, Cholesky, and QR Factorization · Linear Algebra for Data Science: Principal Component Analysis (PCA) and Data Compression (SVD) · Linear and Nonlinear Regression Models

	· Iterative Methods for Nonlinear Regression and Optimization · The Google PageRank Problem and Numerical Eigenvalue Methods
Themen der Lehrveranstaltung	· Introduction to Computational Modelling, Numerical Error, and Finite-Precision Computation · Numerical Linear Algebra: LU, Cholesky, and QR Factorization · SVD, Data Compression, and Principal Component Analysis · Least Squares, Linear and Nonlinear Regression, and Gauss–Newton Method · Dynamical Models: Numerical ODEs and Parameter Estimation · Eigenvalue Problems and the Google PageRank Model
Stichwörter	Computational modelling; numerical linear algebra; least squares; singular value decomposition; parameter estimation.
Empfohlene Voraussetzungen	
Propädeutische Lehrveranstaltungen	
Unterrichtsform	The course includes frontal lectures and exercises.
Anwesenheitspflicht	Attendance is not mandatory but strongly recommended. Non-attending students should contact the lecturer at the start of the course to agree on the modalities of the independent study.
Spezifische Bildungsziele und erwartete Lernergebnisse	Knowledge and understanding: - D1.1: Have a solid knowledge of mathematical analysis, algebra, numerical calculus, discrete mathematics and elementary notion of logic that are in support of computer science. Applying knowledge and understanging: - D2.1: Be able to use the tools of mathematics and logic to solve problems. Ability to make judgments: - D3.2: Be able to work autonomously according to the own level of knowledge and understanding. Communication skills: - D4.1: Be able to use one of the three languages English, Italian and German, and be able to use technical terms and communication appropriately.

	Learning skills: - D5.1: Have developed learning capabilities to pursue further studies with a high degree of autonomy.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	The written exam will include verification questions, transfer-of-knowledge questions, and exercises. The aim is to assess the extent to which students have acquired knowledge and understanding, are able to apply that knowledge, and can demonstrate critical judgment. The same assessment criteria apply to both attending and non-attending students.
Bewertungskriterien	The final written exam accounts for 100% of the grade and covers the entire program. Exam questions will be assessed based on correctness, clarity, quality of argumentation, and problem-solving ability. The same evaluation criteria apply to both attending and non-attending students.
Pflichtliteratur	· M. T. Heath, *Scientific Computing: An Introductory Survey*, revised 2nd ed., SIAM, 2018.
Weiterführende Literatur	· A. Greenbaum and T. P. Chartier, *Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms*, Princeton University Press, 2012 · J. Shlens, "A Tutorial on Principal Component Analysis," 2014 · D. F. Griffiths and D. J. Higham, *Numerical Methods for Ordinary Differential Equations: Initial Value Problems*, Springer, 2010 · Lecture slides, selected articles, MATLAB documentation
Weitere Informationen	If the use of specific software is required, it will be communicated during class by the lecturer.
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung