Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Höhere Mathematik II
Code der Lehrveranstaltung	42443
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	MATH-03/A
Sprache	Italienisch
Studiengang	Bachelor in Elektro- und Informationstechnik
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Maria Letizia Bertotti, MariaLetizia.Bertotti@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/26965
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	1
KP	9
Vorlesungsstunden	60
Laboratoriumsstunden	30
Stunden für individuelles Studium	135
Vorgesehene Sprechzeiten	27
Inhaltsangabe	Detailed description: Functions of several real variables. Generalities. Limits and continuity. Partial derivatives. Higher order derivatives. Partial derivatives of composed functions. Linear approximation and differentiability. Vector valued functions: Jacobian matrix. The gradient and directional derivatives. Taylor formula and approximations. Local and global maxima and minima.

	Hessian matrix. Critical points and their classification. Constrained maxima and minima: Lagrange multiplier method. Least square method and linear regression. Elements of linear programming. Curves. Length of a curve. Curvilinear integrals of scalar functions and vector fields. Conservative fields. Necessary conditions and sufficient conditions for a field to be conservative. The gradient, the divergence and the rotor and their applications in physics. Double and triple integrals. Surface integrals of scalar functions. Models expressed by differential equations. Explicit systems of differential equations of the first order. Existence and uniqueness of the solution of a Cauchy problem. Differential equations of the second order. Linear equations with constant coefficients, homogeneous and non-homogeneous. Examples from physics and other disciplines.
Themen der Lehrveranstaltung	- Functions of several variables (differential calculus) - Vector functions, curves and vector fields - Double and triple integrals - Line integrals and surface integrals - Elements of Ordinary Differential Equations (essentially, linear equations)
Stichwörter	- Functions of several variables - Scalar and vector fields - Double and triple integrals - Line and surface integrals - Elements of Ordinary Differential Equations
Empfohlene Voraussetzungen	Although there are no formal prerequisites, knowledge of the content of the courses of Mathematical Analysis I and Geometry is strongly recommended.
Propädeutische Lehrveranstaltungen	
Unterrichtsform	Frontal lectures and exercises
Anwesenheitspflicht	suggested
Spezifische Bildungsziele und erwartete Lernergebnisse	The course belongs to the "area di apprendimento di base", and more specifically to the scientific area of mathematics, informatics, statistics. It is a core course. The course provides a general overview of scientific tools and contents.

	The educational objectives of the course are given by the knowledge of the concepts and techniques of multivariable differential calculus, vector functions and vector fields. Such a knowledge is necessary for an understanding of the content of several among the courses in the bachelor program. The emphasis is on the ability to formulate in mathematical terms and then solve problems involving several variables, and in particular geometric-type problems in a three-dimensional space, to find relative and absolute maxima and minima of functions of two or more variables, to find constrained maxima and minima, to calculate simple double and triple integrals, with special attention to those of interest in mechanics and physics, to know how to employ spherical and cylindrical coordinates, to calculate simple curvilinear or surface integrals, both of a scalar and a vector field. Also, an introduction to the theory of ordinary differential equations is part of the course. For example, students learn how to solve certain linear equations. Finally, if there is time, the use of a software as Maple or Mathematica in connection with the topics in the course is illustrated to the students.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	Knowledge and understanding: 1. Knowledge and understanding of concepts, symbolism, and techniques of multivariable differential calculus and of vector differential calculus. 2. Knowledge and understanding of basic mathematical modelling and basic elements of differential equations. Applying knowledge and understanding: 3. Applying knowledge and understanding in solving exercises and problems (arising, in particular in engineering) that require formalization, tools and methods learned in the course, for example, finding absolute, relative, or constrained maxima and minima of functions of several variables, calculating simple double and triple integrals, curvilinear and surface integrals of scalar fields, finding the solutions of specific linear ordinary differential equations. Making judgments: 4. Ability to choose a right approach and convenient tools towards tackling problems and questions which can be mathematically formulated. Communication skills:

	5. Ability to report on the calculations in a clear and effective way. Learning skills: 6. Ability to autonomously extend and adapt the acquisition and assimilation of the symbolism, methods and tools of this course for the understanding of the content of a consistent part of the courses in this academic curriculum.
Art der Prüfung	Written exam consisting in a number of exercises containing various specific questions, relative to the topics of the program. The student receives a form (a folded A3 sheet of paper, with four pages) prepared by the lecturer, on which reporting, for every exercise, both the theoretical formulae or arguing which justify the choice of the methods and tools employed by the student and the calculations which lead to the result. Written exam and exercises - 2,5 hours
Bewertungskriterien	The evaluation is expressed through a unique mark. For the exam to be passed, the mark must be greater or equal to 18/30. Shortly, the following are relevant for the evaluation: the identification of a adequate solution method, the knowledge about which formulae and/or tools to apply and/or use, the logic and clarity of the argument, the ability to correctly complete the exercises, the number of exercises solved. More in detail, the evaluation is based on: 1. the knowledge and understanding of the course issues: indeed, the student must understand the questions and place them exactly in the context of the theory explained in the course (weight in awarding marks is 30%). 2. the ability to apply acquired knowledge and understanding: the student must solve the exercises, thus applying the theoretical knowledge and understanding of the course issues (weight in awarding marks in connection with the methods employed is 30%). Of course, also the fact whether calculations are correct or not is significant (weight in awarding marks is 10%); 3. the making judgements: the student chooses solution method, which is not always unique and the ability of making judgments is evaluable based on this choice

	(weight in awarding marks is 10%); 4. the clarity and completeness of the description: they allow evaluation of communication skills (weight in awarding marks is 10%). 5. Altogether, the way how the written examination is worked out allows to assess the learning skills of the student (weight in awarding marks is 10%)
Pflichtliteratur	Robert A. Adams & Christopher Essex, Calcolo Differenziale 2. Funzioni di più variabili, Casa Editrice Ambrosiana (2014), or also one of the previous versions, for example:Robert A. Adams, Calcolo Differenziale 2. Funzioni di più variabili, Casa Editrice Ambrosiana (2007)
Weiterführende Literatur	
Weitere Informationen	Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it and Ilaria Miceli, Ilaria.Miceli@unibz.it
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung, Weniger Ungleichheiten, Menschenwürdige Arbeit und Wirtschaftswachstum