Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Elemente der Mathematik und der Statistik
Code der Lehrveranstaltung	40450
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	MATH-04/A
Sprache	Englisch
Studiengang	Bachelor in Lebensmittelwissenschaften, Önologie und Gastronomie
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Giovanni Modanese, Giovanni.Modanese@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/494
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
Studienjahr/e	1st
KP	8
Vorlesungsstunden	48
Laboratoriumsstunden	32
Stunden für individuelles Studium	120
Vorgesehene Sprechzeiten	24
Inhaltsangabe	Properties of functions, Polynomials and applications, Exponentials, logs and applications, Trigonometry, Derivatives and integrals, Differential equations in life sciences. Elements of probability and statistics. Random variables.
Themen der	Functions 1: Definitions, notation y=f(x). Table and graph of a

Lehrveranstaltung	function. Domain and range, simple examples, recall of integer and fractional equations and inequalities of I, II degree. Injective functions. Polynomial functions of I and II degree. Functions x^n, n-th root, sinx, cosx, lnx, e^x. Range of rational fractional functions. Derivatives and integrals: Derivative of a function, incremental ratio and tangent line. Numerical examples. Derivatives of the elementary functions, of products and ratios. Derivative of function of function. Physical notation "dy/dx", chain rule dy/dx=(dy/du)(du/dx). Maxima, minima and horizontal inflection points. Simplified scheme for studying the graph of a function (without asymptotes and convexity). Examples of functions containing roots and logarithms. Indefinite integrals. Elementary primitives. Integration rules. Applications to kinematics: uniform and accelerated motion. Definite integrals. Geometrical meaning. Application to dynamics: work of an elastic force. Fundamental theorem of the integral calculus. Integration by parts and by substitution. Functions 2: Taylor polynomial of second degree. Convexity, second derivatives. Inverse functions and their graphs. Inverse of the elementary functions. Restrictions of the domain. Relationship between the range of a function and the domain of its inverse. Derivative of the inverse function. Limits at finite and infinite. Limits of the elementary functions. Determinate and indeterminate forms. Elimination of the indetermination. Limits of rational functions. Horizontal and vertical asymptotes. Rule of de l'Hopital. Differential equations: concept of differential equation of the I order. Direct verification of the solutions. Equations with separation of variables. Logistic equation. Linear equations of the I order. Applications of exponential and log functions: bacteria replication, radiocarbon dating, half-life of radioactive isotopes for medical treatment. Applications of goniometric functions: height measurements of trees in agriculture and forestry. Descriptive statistics. Data from a population. Histogram of frequencies. Median, quartiles, average, standard deviation,

	weighted mean, interquartile range. Covariance and correlation. Regression line. Probability. Empirical definition. Laplace definition. Relative frequency. Sample space. Events. Fundamental properties of probability. Basic theorems of probability. Conditional probability and independence. Bayes' formula. Contingency tables. The binomial formula. Discrete random variables. Expectation value. Covariance of two RVs. Standardization of a RV. Bernoulli RV. Binomial RV. Poisson RV. Continuous RVs. Probability density. Normal Gauss RV. Application of statistical indicators and normal distribution: the statistics of testing methods of the quality of olive oil according to IOC standards.
Stichwörter	Functions; Differential and integral calculus; Probability and statistics; Random variables
Empfohlene Voraussetzungen	
Propädeutische Lehrveranstaltungen	None
Unterrichtsform	Frontal lectures and exercises
Anwesenheitspflicht	No
Spezifische Bildungsziele und erwartete Lernergebnisse	Knowledge and understanding: Upon completion of their studies, graduates with a bachelor's degree in Food and Enogastronomy Sciences will have acquired a solid foundation of scientific knowledge in disciplines such as chemistry, physics, biology, mathematics, computer science, and law, specifically applied to the food and gastronomic sector. They will gain technological skills for managing production and transformation processes, along with an integrated view of the quality, safety, and sustainability of food supply chains and systems. In addition, graduates will understand the principles related to waste reduction, resource optimization, and the reconciliation of economics and ethics, which are central elements for addressing

	the modern challenges of the agri-food system. The knowledge and understanding skills mentioned above are acquired through participation in lectures, practical exercises, seminars, and through guided personal study and individual study as provided by the activated educational activities. The verification of the achievement of learning outcomes is mainly carried out through exams and any interim tests. The tests may be written and/or oral, and may also consist of reports and oral presentations of projects or seminars. Making judgements: Evaluate and critically analyze the quality, safety, and sustainability of production processes and food products, considering scientific, technological, economic, and cultural aspects. Students will be able to make informed decisions based on scientific data and the analysis of production contexts to ensure the excellence of the final product. Interpret and manage complex data collected through chemical, physical, microbiological, and sensory analyses, in order to improve the quality of food products and effectively respond to food safety needs and regulatory requirements of the sector. Communication skills: Communicate effectively and appropriately with both technical and non-technical interlocutors, including professionals in the food and gastronomic sector, public and private institutions, and the general public. This includes the ability to adapt the communication style based on the audience, using the specific technical language of the food and gastronomic sector when necessary. Present and discuss the results of their analyses and research in both written and oral form, using technological and multimedia tools. Graduates will be able to draft technical reports, research papers, and scientific documents, as well as present their results clearly and structured, for example during conferences, seminars, or business meetings.

	Actively participate in discussions and group work in multidisciplinary and international contexts, demonstrating active listening, negotiation, and collaboration skills. Practical experiences and internships will provide students with the abilities to work effectively in teams and contribute to solving complex problems in the sector. Use the three languages of instruction of the course (Italian, German, and English) fluently and confidently, both for written and oral communication. Thanks to the trilingual approach of the Free University of Bozen-Bolzano, graduates will be able to face international work contexts, participate in global networks, and contribute to the development of international cooperation projects to address the challenges of the food and gastronomic sector. Learning skills: At the end of the degree program, graduates will have developed strong learning skills, essential for successfully continuing academic studies and entering the workforce. In particular, they will be able to: Learn autonomously and continuously, keeping up to date with scientific and technological advancements in the food and gastronomic sector. Graduates will have acquired study methods and research tools that will allow them to independently update their skills, critically interpreting new knowledge. Effectively manage the learning of complex concepts by integrating the various scientific and technical disciplines covered in the degree program, such as chemistry, biology, food technologies, economics, and law. They will be able to identify the most relevant sources, understand and apply new methodologies, and adapt to sector developments. Develop collaborative learning strategies, thanks to the experience gained through group work, internships, and laboratory activities. Graduates will be able to share their knowledge and learn from others, demonstrating adaptability and teamwork skills. Continue their studies independently in Master's degree programs (such as the LM-70 class, Food Science and Technology, currently offered at the same university) or in other related fields, using the skills and methods acquired during the bachelor's degree to tackle

	new learning challenges, even in high-level academic and professional contexts.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	Written exam, 180 minutes. No support allowed, except one formula sheet for mathematics and one for statistics, probability tables prepared by the teacher, scientific calculator (not graphic) with statistical functions. The exam will consist of exercises.
Bewertungskriterien	The ability to accurately trace the solution will be more important than the final calculation result. The final mark will be determined as the weighted average from the marks in statistics and mathematics. Students will pass the exam if they achieve a mark of 18 or higher in both parts.
Pflichtliteratur	Mathematics: R.A. Adams, Single variable calculus, SK 400 A 216 (3) or (6). Also SK 400 A 216 (7) or (8) (library reserve collections). Teacher's slides in the electronic reserve collection. Statistics: Heumann, Christian/ Schomaker, Michael/ Srivastava, Shalabh. Introduction to Statistics and Data Analysis: With Exercises, Solutions and Applications in R, Part I (2016). Web. ISBN 3-319-46162-1, Springer International. Free PDF available from the Unibz Library. Teacher's slides in the electronic reserve collection.
Weiterführende Literatur	
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung