Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Mathematik und Angewandte Statistik
Code der Lehrveranstaltung	40211
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	NN
Sprache	Englisch
Studiengang	Bachelor in Nachhaltiger Land- und Forstwirtschaft in Berggebieten
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Giovanni Modanese, Giovanni.Modanese@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/494 Prof. Paolo Girardi, Paolo.Girardi2@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35917
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
Studienjahr/e	1
KP	10
Vorlesungsstunden	60
Laboratoriumsstunden	40
Stunden für individuelles Studium	150
Vorgesehene Sprechzeiten	30
Inhaltsangabe	Mathematics for Agriculture and Forestry : Properties of functions, Polynomials and applications, Exponentials, logs and applications, Trigonometry, Derivatives and integrals, Differential equations in

	life sciences. Applied Statistics and Data Analysis: Descriptive statistics and probability, Random variables, Confidence intervals, Hypothesis testing, Correlation and linear regression.
Themen der Lehrveranstaltung	MATHEMATICS MODULE Functions 1: Definitions, notation y=f(x). Table and graph of a 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. STATISTICS MODULE

	1. Introduction to Descriptive Statistics and Probability: this section introduces the role of statistics in applied research, focusing on how data can be summarized and visualized through tables, graphs, and summary measures such as mean, median, variance, and standard deviation. Students also learn the basic principles of probability, including conditional probability and Bayes' theorem, as the foundation for statistical inference. 2. Random Variables: Discrete and Continuous. We discuss random variables as models of uncertainty, distinguishing between discrete and continuous types. Key probability distributions such as the Binomial, Poisson, Normal, and Exponential are introduced, with attention to their properties, applications, and the role of the Central Limit Theorem in approximating real-world data. 3. Confidence Intervals: This part explains how sample data can be used to estimate population parameters with an associated level of confidence. Students practice constructing and interpreting confidence intervals for means, proportions, and differences, emphasizing their practical meaning in applied contexts. 4. Hypothesis Testing: Students learn the logic of hypothesis testing, including formulating hypotheses, understanding errors and significance levels, and interpreting p-values. Applications include tests for means, proportions, variances, and categorical data (chi-square tests), as well as an introduction to ANOVA and non-parametric methods. 5. Correlation and Linear Regression: Correlation is used to measure the strength and direction of association, while regression provides a predictive framework. Emphasis is placed on interpreting coefficients, assessing model fit, and diagnosing potential issues in applying regression to real data.
Stichwörter	Functions, Derivatives and integrals, Statistics and probability, Random variables, Hypothesis testing, Correlation and linear regression
Empfohlene Voraussetzungen	
Propädeutische	no

Lehrveranstaltungen	
Unterrichtsform	Frontal lectures, exercises on the PC with R.
Anwesenheitspflicht	no
Spezifische Bildungsziele und erwartete Lernergebnisse	Knowledge and understanding - Ability to apply knowledge and understanding: The degree course provides advanced knowledge for the training of professionals capable of carrying out management and coordination activities in mountain and forestry agriculture, as well as effectively preparing students for possible further studies. The knowledge and skills acquired provide graduates with planning, management, control, coordination and training skills in agriculture and forestry. All these skills will be transmitted to the graduates by means of face-to-face lecturing, technical and practical laboratory exercises, field exercises and educational-scientific excursions. The elaboration of the experimental thesis may be carried out both in the faculty's laboratories and in companies and local authorities. At the end of their studies, the three-year graduate at Sustainable agriculture and forest management in mountain environment possesses basic knowledge of mathematics, physics, chemistry, statistics, and the biology of plant and animal organisms and microorganisms. The expected learning outcomes can therefore be summarised as: - understanding of the concept of function and the basic principles governing integral calculation by functions; - adequate statistical and data analysis skills - being able to read and understand advanced texts relating to the various aspects characterising the agrarian and agro-forestry environment in mountainous areas - being able to communicate and discuss issues relating to the training course in an appropriate manner in the three languages (Italian, English, German). The knowledge and comprehension skills listed above are achieved through participation in lectures, practical exercises, seminars, and through guided personal and individual study as envisaged by the training activities offered. Some courses in the syllabus may be offered in a dual mode (lectures face-to-face and in video-recorded form and made available on the university intranet platform) The assessment of the achievement of learning outcomes takes

	place mainly by means of exams and possible in -progress tests. The tests may be written and/or oral, and may also consist of reports and oral presentations of projects or seminars. The ability to apply knowledge is achieved through critical reflection on the texts proposed for individual study stimulated by classroom activities, the study of research and application cases shown by the lecturers, the performance of practical laboratory and field exercises, bibliographical research, individual and/or group projects as part of the fundamental and optional courses included in the teaching plan, as well as during the internship and preparation for the final examination. The tests carried out by means of written and/or oral examinations, reports and exercises include the performance of specific tasks in which the student demonstrates mastery of tools, methodologies and critical autonomy. In the internship activities, the verification takes place through the presentation of a report by the student to the teacher of reference. Making judgements: Autonomy of judgement is developed and verified through the exercise activities, the organised seminars, the preparation of papers as part of the teaching, as well as during the internship activity and the activity assigned by the lecturer for the preparation of the final examination. Communication skills: The graduate has the ability to use the most modern and effective means of communication to disseminate the research carried out and the analyses relating to the problems of agro-forestry and forest management; he/she is able to deal with the production realities in the agro-forestry sector and to interact with figures from the sector and related sectors. Communication skills are particularly developed during exercises, the organised seminars, as well as during training activities that also involve the preparation of reports and written documents and the oral presentation of the same. Since the course is trilingual, graduates are able to communicate correctly, in written and oral form, in Italian and in two other languages (German and English). In tutorial activities and seminars, students are encouraged to speak publicly in order to improve their ability to describe clearly and comprehensibly any doubts and/or requests for clarification on

	specific topics. The acquisition and evaluation/verification of the achievement of communication skills are also provided for during the internship and the final report, as well as when writing and discussing the final paper. Learning skills: The degree course provides the basic cognitive tools indispensable for the continuous updating of knowledge, also with tools that make use of new communication and information technologies. The graduate is able to apply the developed learning methods and tools to update and deepen the studied contents, also in professional contexts and to undertake further studies.
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. For mathematics the exam will consist of exercises. For statistics: written exam and previous Project work. The written exam will include 8-10 questions (that is, exercises and theory questions). The programming language R will be asked by correctly interpret numerical and graphical outputs generated using R. The project work will consist of an individual report, prepared using R, based on the analysis of a dataset. The report, with a maximum length of 6 pages, should be structured into four sections: - Data and research hypothesis: a clear description of the dataset and the scientific question under investigation; - Methodology: the statistical techniques applied and their justification; - Results: presentation and interpretation of the main findings; - Conclusions: a concise summary of the outcomes and their implications.
Bewertungskriterien	The ability to accurately trace the solution will be more important than the final calculation result. In the Project work, the ability to identify a scientific hypothesis and the appropriate statistical method, and the ability to synthesize and present data and results,

	will be evaluated. Maximum 3 points more will be added for the Project work to the mark of the written statistics exam. 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. Applied 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

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Mathematik für Landwirtschaft und Forstwirtschaft
Code der Lehrveranstaltung	40211A
Wissenschaftlich-disziplinärer Bereich	MAT/07
Sprache	Englisch
Dozenten/Dozentinnen	Prof. Giovanni Modanese, Giovanni.Modanese@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/494
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	
KP	5
Verantwortliche/r Dozent/in	

Vorlesungsstunden	30
Laboratoriumsstunden	20
Stunden für individuelles Studium	75
Vorgesehene Sprechzeiten	
Inhaltsangabe	Properties of functions, Polynomials and applications, Exponentials, logs and applications, Trigonometry, Derivatives and integrals, Differential equations in life sciences.
Themen der Lehrveranstaltung	Functions 1: Definitions, notation y=f(x). Table and graph of a 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.

Unterrichtsform	Frontal lectures and exercises
Pflichtliteratur	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.
Weiterführende Literatur	Mathematics with applications for the management, life, and social sciences, Howard Anton, Bernard Kolman. Academic Press, 1982. Free PDF available from the Unibz Library.

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Angewandte Statistik und Datenanalyse
Code der Lehrveranstaltung	40211B
Wissenschaftlich-disziplinärer Bereich	SECS-S/01
Sprache	Englisch
Dozenten/Dozentinnen	Prof. Paolo Girardi, Paolo.Girardi2@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35917
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	
KP	5
Verantwortliche/r Dozent/in	
Vorlesungsstunden	30
Laboratoriumsstunden	20
Stunden für individuelles Studium	75
Vorgesehene Sprechzeiten	15
Inhaltsangabe	Descriptive statistics and probability, Random variables, Confidence intervals, Hypothesis testing, Correlation and linear regression.
Themen der Lehrveranstaltung	
Unterrichtsform	Frontal lectures, exercises on the PC with R.

Pflichtliteratur	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	