

Syllabus

Course description

Course title	Elements of Mathematics and Statistics
Course code	40450
Scientific sector	MAT/07
Degree	Bachelor in Food and Enogastronomy Sciences
Semester	1st
Year	1st
Credits	8
Modular	<i>no</i>

Total lecturing hours	48
Total lab hours	
Total exercise hours	32
Attendance	Not required, but strongly suggested
Prerequisites	Basic Math at a Bachelor course level
Course page	See ole.unibz.it

Specific educational objectives	<u>Mathematics:</u> The course aims at reinforcing the mathematical skills acquired by students in the high school, in particular the concepts of function and equation, which are indispensable for any study course in life sciences and for the Statistics module. The contents of the course are also organized in coordination with the Physics course. For this reason, lessons start with the part about elementary differential and integral calculus. Next, a simple introduction to first order differential equations is given, seen as a natural application of calculus to real-world models. <u>Statistics:</u> The students will be able to: • analyze their own data statistically and to present them graphically • judge critically scientific results and conclusions • use specific functions of the statistical software package R • apply methods of inferential statistics
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Lecturer	Giovanni Modanese, Room B1.5.09 (NOI BZ), giovanni.modanese@unibz.it , tel. +0471013134, webpage https://www.unibz.it/it/faculties/engineering/academic-staff/person/494-giovanni-modanese
Scientific sector of the lecturer	MAT-07

Teaching language	English
Office hours	By appointment
Teaching assistant (<i>if any</i>)	
Office hours	
List of topics covered	Mathematics: <u>Functions 1:</u> 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, $\sin x$, $\cos x$. 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. <u>Functions 2:</u> 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 equation, fits, optimization: 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. Linear and quadratic interpolation. Problems of forecasting. Statistics: 1. Introduction to descriptive statistics and probability 2. Random variables discrete and continuous 3. Confidence intervals 4. Hypothesis testing 5. Correlation and linear regression

Teaching format	Frontal lectures, exercises, labs, projects
Assessment	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.
Assessment language	English
Evaluation criteria and criteria for awarding marks	The ability to accurately trace the solution will be more important than the final calculation result.
Required readings	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.
Supplementary readings	