



COURSE DESCRIPTION FORM

Degree course:	L
Teaching denomination:	Mathematics and Statistics – Mathematics Module
Credits Number:	6
Semester:	2
Teacher:	Giuliano Gargiulo
Assistant Professors/Instructors:	/
Tutoring schedule:	giuliano.gargiulo@unisannio.it teacher's office, by appointment
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PRESENTATION OF THE COURSE

Mathematics allows mastery of tools for modeling fundamental fields of science, including Chemistry and Physics (the "book written in the mathematical language" for G. Galilei). Its fundamental methodological "product", far beyond that, is however clarity and understanding.

THE FORMATIVE OBJECTIVES

Knowledge of the mathematical notions of functions and mathematical models in the sciences. Reading and Interpreting graphs. Manipulation of equations and inequalities. Meaning and computation of elementary indefinite integrals.

COURSE PREREQUISITES

Elements of Set Theory, computation rules in rings and fields (properties of rational operations, rules for parentheses), real numbers and their representation in the Cartesian plane, coordinate systems. Polynomials and operations with polynomials. Basic schemes for resolution of equations and inequalities of degree up to two. Algebraic inequalities of degree up to two and graphical representation of the set of solutions, operations with algebraic polynomials (sum, difference, product, quotient), factorization of algebraic polynomials (factoring by grouping, Ruffini-Horner-Cauchy rule, recognizable patterns), operations with radicals.

FREQUENCY OF LESSONS

Strongly recommended; in particular, in view of simulation of exams and tests during the course, reserved for the students attending the course.

COURSE CONTENTS

Functions. Numeric functions, injective, surjective and bijective functions. Restrictions and extensions. Monotonicity and extremes. Inverse and composite functions. Functions graphs. Symmetry of graphs and functions. Elementary functions and their properties.

Sequences. Limits. Limit uniqueness theorem. Sign Permanence Theorem. Limit and comparison. "carabinieri" (squeeze) theorem. Limits and operations: indeterminate forms. Some remarkable limits. Monotone sequences and their properties. Euler's number E . Subsequences and Bolzano-Weierstrass theorem.

Function Limits. Limits and asymptotes. Accumulation (limit) points. Left- and Right-hand Limits. Limit uniqueness theorem. Limits of elementary functions. Function limits and comparison. Sign Permanence Theorem, "carabinieri" (squeeze) theorem. Limits and operations: indeterminate forms. Notable special limits.

Continuous functions. Weierstrass's Theorem. Bolzano's (zero) Theorem. Intermediate value theorem.

Differential Calculus. Geometrical meaning of derivative. Differentiability and continuity. Derivatives of Elementary functions. Differentiation rules. Theorems of Rolle, Lagrange (mean value), Cauchy and their consequences. L'Hospital's rule. Characterization of monotone functions over intervals. Local (relative) extrema: Fermat's theorem; sufficient conditions. Concavity and convexity. Function graphs.

Integral Calculus. Indefinite integrals: primitive functions; characterization of indefinite integrals. Integrals of elementary functions; integration schemes ("almost immediate" integrals). Partial fraction decomposition algorithms. Integration by parts and by substitution. Area bounded by a positive continuous function over an interval; definite (Riemann) integral and its properties. Mean value theorem for definite integrals and fundamental theorems of calculus

TEACHING METHODS

Frontal instruction (lectures)

TEXTBOOKS

Textbook 1 C. Sbordone, P. Marcellini, *Elementi di Analisi Matematica Uno*, Liguori ed.

Textbook 2 F. Casolaro, *Integrali*, Zanichelli ed.

Sample problems and solutions, in digital format

FINAL EXAMINATION

The examination consists of a written test and an oral test; passing the written test is a necessary condition for access to the oral exam. Written examination and oral examination have equal weights in grading.

The written test lasts two hours and consists of three exercises, one of which usually has two options to choose from.

As far as the oral exam is concerned, the evaluation elements are, in the order from the most significant to the least significant:

the relevance of the answers to the questions asked, the quality of the content, the technical language proficiency, the ability to establish links with other subjects covered by the programme, the ability to bring examples, the overall expressive capacity of the student.

There are two (intermediate) written tests for attending students; one at half course and another at its end. Passing the intermediate tests implies passing the written part of the exam.

EXAM SCHEDULE

<http://www.dstunisannio.it/index.php/studenti/appelli-esami>

EXAM BOOKING PROCEDURE

<https://unisannio.esse3.ccineca.it>

SYLLABUS

Topics	Hours	Bibliographical references	Type of lesson
real numbers, extrema, equations and inequalities	4	Textbook 1	frontal, exercise
Abstract and elementary functions	6	Textbook 1	frontal
Sequences	8	Textbook 1	frontal
Function limits	4	Textbook 1	frontal
Continuous functions	4	Textbook 1	frontal
Derivatives	4	Textbook 1	frontal, exercise
Applications of differential calculus	6	Textbook 1	frontal
Tools for the study of graphs	4	Textbook 1	frontal
Indefinite integration	6	Textbook 2- exercises and outlined solutions	frontal, exercise
Definite integration	4	Textbook 1 - Textbook 2	frontal
Qualitative study of graphs	4	Textbook 1 - exercises and outlined solutions	frontal, exercise