UNIVERSITÀ degli STUDI di CATANIA

DEPARTMENT OF ECONOMICS AND BUSINESS
Bachelor's Degree in Business Administration
Academic Year 2021/2022 - 1° Year

GENERAL MATHEMATICS A - O

SECS-S/06 - 9 CFU - 1° Semester

Teaching Staff

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LEARNING OBJECTIVES

1. Knowledge and understanding:

The purpose of the course is the acquisition of some mathematical tools which are preparatory for all professional subjects, such as financial mathematics, statistics, economics, and business.

The teaching methodologies are designed to develop students' inductive-deductive logical skills.

The exam is composed of a written test and an oral examination, withe the goal of testing for the student's mathematical knowledge, his understanding of the abstract concepts, and their translation into formal notions.

During the entire course, knowledge and understanding are tested on a continuous basis, and a fruitful and active participation by students is always stimulated.

2. Applying knowledge and understanding:

Particular attention is paid to the activity of future graduates, who have been called to deal with interdisciplinary subjects.

To this end, instructors use a teaching method oriented toward the acquisition of the technical tools in a continuous process of interaction between analysis and synthesis.

3. Making judgments:

Mathematics for Social Sciences allows students to acquire the tools to assess economic phenomena in quantitative terms, linking them to the law/business aspects that some other disciplines of Business Administration deal with.

4. Communication skills:

The course should provide students with the ability to transfer their technical knowledge to other

subjects. In particular, the teaching will put the student in a position to identify the quantitative aspects of typical problems in economics and business, and resolve them after a suitable mathematical formalization.

5. Learning skills:

Students should acquire skills to deal not only with other mathematically oriented subjects but also with the resolutions of issues related to economic and financial management.

COURSE STRUCTURE

The structure of the course is basically articulated in two parts:

1) General knowledge of several branches of mathematics non directly related to real function (points 1-9 below)

2) Real functions (points 10-13 below)

DETAILED COURSE CONTENT

1. **ELEMENTS OF LOGIC:** Languages. Formulas. Connectives. Quantifiers. Truth table. Tautology and contradiction. Implication and equivalence. Axiom, theorem and conjecture. Example and counterexample.

2. **ELEMENTS OF SET THEORY:** Set and subsets. Operations. Functions. Binary relations. Equivalence relations. Orderings.

3. **COMBINATORICS:** Ordered and unordered selections. Arrangements. Permutations. Combinations. Selections allowing repetitions. Newton’s binomial formula. Properties of binomial coefficients. Pigeonhole principle and inclusion-exclusion principle. Applications to concrete problems.

4. **NUMBERS:** The set of natural numbers. The set of integers. The set of rational numbers. The set of real numbers. Powers with a real exponent.

5. **PROPERTIES OF SETS OF REAL NUMBERS:** Infimum and supremum. Cluster points. Boundary. Interior. Closure. Bolzano-Weierstrass theorem.

6. **GEOMETRY:** Elements of trigonometry. Cartesian coordinates. Lines on a plane. Equation of a line. Parallelism and perpendicularity. (

7. **MATRICES AND DETERMINANTS:** Main definitions. Operations: addition, multiplication, scalar product, transposition. The inverse of a square matrix. Determinant and its properties. Rank of a matrix.

8. **LINEAR SYSTEMS:** Dependence among linear forms. Definitions and properties. Regular linear systems: Cramer’s rule. Rouchè-Chapterelli’s theorem. Linear systems with parameters.

9. **ALGEBRAIC STRUCTURES:** Groups. Rings. Fields. Vector spaces. Distance in Euclidean spaces.

10. **REAL FUNCTIONS OF A REAL VARIABLE:** Definitions, classifications, geometric representation. Limits: definitions and theorems. Sequences of real numbers. Neper’s number. Continuous functions. Composition of functions. Inverse function. Infinitely small and infinitely large.

11. **DERIVATIVE AND DIFFERENTIAL:** Definitions, properties and their geometric interpretation. Simple derivatives. Operations: derivative of a sum, product and quotient of functions. Chain rule. Derivative of the inverse of a function. Higher order derivatives and differentials. Main theorems on differentiable functions.

12. **APPLICATIONS OF DIFFERENTIAL CALCULUS:** Theorems of Rolle, Cauchy and Lagrange. De l'Hopital's rule. Taylor's and Mac Laurin's formulas. Indeterminate forms. Monotone functions. Convex functions. Local maximum and minimum. Absolute maximum and minimum. Main theorems on continuous and derivable functions. Asymptotes. Geometric representation of a function.

13. **THEORY OF INTEGRATION:** Indefinite integral and primitives of a function. Integration by decomposition, by parts and by substitution. Definite integral and its geometric meaning. Methods of definite integration.

TEXTBOOK INFORMATION

1) S. Corrente, B. Matarazzo, S. Greco, S. Milici, "*Matematica Generale*". Ed. Giappichelli, 2020.

2) A. Giarlotta, S. Angilella, "*Matematica Generale. Teoria e Pratica con Quesiti a Scelta Multipla*". Volume I. 2nd Edition. Giappichelli, 2017.

3) A. Giarlotta, "*Esercizi di Matematica Generale*". Volume I. Giappichelli, 2020.
