COURSE DETAILS

"ANALISI MATEMATICA I"

SSD MAT/05

DEGREE PROGRAMME: BACHELOR DEGREE IN COMPUTER ENGINEERING

ACADEMIC YEAR: 2023-2024

GENERAL INFORMATION – TEACHER REFERENCES

TEACHER: MULTIPLE STUDY COURSE
PHONE:
EMAIL:

SEE THE STUDY COURSE WEBSITE

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE): N.A.
MODULE (IF APPLICABLE): N.A.
CHANNEL (IF APPLICABLE): N.A.
YEAR OF THE DEGREE PROGRAMME (I, II, III): I
SEMESTER (I, II): I
CFU: 9

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")
None.

PREREQUISITES (IF APPLICABLE)
The mathematical content of secondary school curricula.

LEARNING GOALS
Provide the fundamental concepts, in view of applications, related to infinitesimal, differential and integral calculus for real functions of a real variable; to acquire adequate skills of logical formalization and conscious operational ability.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding
The student must demonstrate knowledge of the notions (definitions, statements, demonstrations if provided by the program) related to infinitesimal, differential and integral calculus for the real functions of a real variable and the calculation tools developed, and be able to understand related topics by elaborating the acquired notions.

Applying knowledge and understanding
The student must demonstrate to be able to apply what has been learned in the resolution of verification exercises developed by the teacher, in principle related to topics such as: fields of existence, limits of sequences and functions, numerical series, function studies, definite and indefinite integration.

COURSE CONTENT/SYLLABUS

(1 CFU) Number sets - Natural, integer, rational numbers. The axioms of real numbers. Upper extremum, lower extremum, maximum, minimum. Archimedes' principle. Density of Q in R; root n-ma; power with real exponent (s.d.). Induction principle. Bernoulli inequality. Binomial formula.

(1 CFU) Basic functions.

(1.5 CFU) Sequences - Limit of a sequence; first properties of limits: theorems of uniqueness of the limit, of comparison, of the permanence of the sign. Operations with limits and indeterminate forms. Monotonic sequences: regularity theorem; The number E. Criterion of the ratio. Root criterion. Theme of arithmetic mean and geometric mean. Relationship-root criterion. Cauchy convergence criterion. Extracted successions. Bolzano–Weierstrass theorem.

(1 CFU) Number series - Definitions and first properties; operations with series. Geometric series, harmonic series and generalized harmonic series. Cauchy criterion for series. Series with non-negative terms: criteria of root, relationship, comparison, asymptotic comparison, infinitesimals. Euler–Mascheroni constant. Series with alternate signs: Leibniz criterion; Estimate of the rest. Absolutely converging series and their properties.

(1 CFU) Functions - Topology of the real line: accumulation points, closed, open, compact. Limits of functions and their properties. Equivalent definition of limit. Operations with limits and indeterminate forms. Monotonic functions: regularity theorems; continuous functions; Lipschitz functions; inverse functions; compound functions. The limit of a compound function. Absolute extremes: Weierstrass' theorem. Zero theorem, intermediate value theorem. Uniformly continuous functions, Cantor's theorem.

(2 CFU) Differential calculus - Definition of derivative and its geometric meaning. Derivation rules; derivatives of elementary functions. Relative details: necessary condition of the first order. Rolle and Lagrange theorems;

characterization of monotonic functions in intervals. Relative extremes: sufficient conditions of the first order. Extension theorem of the derivative. De L'Hôpital's first theorem; de L'Hôpital's second theorem; calculation of limits that occur in an indeterminate form. Infinitesimals and infinites: principles of cancellation. Taylor formula with Peano remainder. Taylor formula with remainder in Lagrange form. Notes on the Taylor series. Relative extremes: necessary conditions and sufficient conditions of the second order. Geometric meaning of the second derivative. Convexity and concavity in one range; characterization of convex functions in intervals; flexed; Asymptotes; function graphs.

(1. 5 CFU) Integral calculus - Notes on the Peano-Jordan measurement. Riemann integral of a bounded function in a compact interval. The area of the rectangle. Integrability of monotonic functions in compact intervals. Integrability of continuous functions in compact intervals. Property of the definite integral. Integral mean theorem. Fundamental theorem of integral calculus. Primitives and indefinite integration. Rules of indefinite integration: decomposition by sum, integration by parts, integration by substitution, integration of rational functions. Generalization of the concept of integral: summability. Summability criteria.

READINGS/BIBLIOGRAPHY

SEE THE TEACHER'S WEBSITE

TEACHING METHODS

The lessons will be frontal, and about a third of the lessons will be exercised.

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	X
only written	
only oral	
project discussion	
other	

In case of a written exam, questions refer to:	**Multiple choice answers**	X
	Open answers	X
	Numerical exercises	X