UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	PHYSICS
INTEGRATED COURSE	MATHEMATICAL ANALYSIS I
CODE	17210
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	MAT/05
HEAD PROFESSOR(S)	TSCHINKE FRANCESCO Ricercatore Univ. di PALERMO
OTHER PROFESSOR(S)	TSCHINKE FRANCESCO Ricercatore Univ. di PALERMO DALBONO FRANCESCA Ricercatore Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	Annual
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**DALBONO FRANCESCA** Thursday 14:00 16:30 **TSCHINKE FRANCESCO** Wednesday 14:00 16:00 Dipartimento di Matematica e Informatica, via Archirafi 34

DOCENTE: Prof. FRANCESCO TSCHINKE

PREREQUISITES	The prerequisites are those provided by the Board for accessing the Bachelor Program.
LEARNING OUTCOMES	KNOWLEDGE AND UNDERSTANDING: The student must know the basic concepts of mathematical analysis (real numbers, limits, derivatives, integrals). APPLYING KNOWLEDGE AND UNDERSTANDING: The student must acquire the ability to use the mathematical tools presented in the course and to use them in theoretical or applicative situations other than those typical of the course. MAKING JUDGEMENT: the student must be able to analyze the data of a problem and identify the mathematical tools to solve it. COMMUNICATION SKILL: the student must be able to express mathematical concepts in a correct and complete way. LEARNING SKILLS: the student must be able to develop and deepen independently additional skills, in particular, to the reading of bibliographic material.
ASSESSMENT METHODS	Final assessment consists of a written test and an oral test. Written tests regard the resolution of a number of questions concerning the various topics covered in the two teaching modules. The written test is intended to evaluate not only the acquired computing capacity, but also the degree of knowledge of the concepts and theorems presented in the course and the ability of the students to apply them independently. The oral test consists of oral questions concerning the statements and demonstrations of key results presented in the course and their application to simple theoretical or practical questions. The oral questions allows to evaluate, not only the knowledge of the candidate and his ability to apply them, but also the possession of ability of language and mathematical rigor. Both the written test and the oral examination are part of the final evaluation.The final assessment will be made on the basis of following conditions:a) Basic knowledge of the proposed topics and limited ability to apply them independently; sufficient ability to carry out a rigorous reasoning and sufficient property of the language (18-21); b) good knowledge of the proposed topics and fairly good ability to apply them independently; good ability to complete a rigorous reasoning and good property of language (22-25); c) In-depth knowledge of the proposed topics and ability to apply them with mathematical rigor, but not independently; command of good mathematical language (26-28); d) in-depth and extensive knowledge of the proposed topics; ability to implement them with readiness, rigor and independently; command of excellent communication skills (29-30L).
TEACHING METHODS	Lectures and other teaching activities run during both semesters but take place in the two educational periods of the first year of the degree program. The didactical activity is developed through lectures and exercises. The lessons are designed to present and discuss the fundamental concepts of mathematical analysis (numbers, sequences, functions, limits, derivatives and integrals) and their consequences. During the exercises students learn how and in what situations to apply the concepts and methods learned during the class. After each teaching module there will be a written (not mandatory) test whose positive outcome can replace, in whole or partly, the final written test.

MODULE
SINGLE VARIABLE DIFFERENTIAL AND INTEGRAL CALCULUS

Prof. FRANCESCO TSCHINKE

SUGGESTED BIBLIOGRAPHY

C.Trapani, Analisi Matematica (funzioni di una variabile reale) Edizione riveduta e corretta, McGraw-Hill 2014 (Prima edizione ISBN: 9788838664397)
P. Marcellini, C. Sbordone, Esercitazioni di matematica, I,II, Liguori (ISBN: 978-8820763510, ISBN: 978-8820752521)

AMBIT	50164-Discipline matematiche e informatiche
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56

EDUCATIONAL OBJECTIVES OF THE MODULE

To learn the language, the reasoning and the calculus methods of mathematical analisis, also through the resolution of suitable problems.

SYLLABUS

Hrs	Frontal teaching
8	De l'Hopital theorems, mimimum, maximumum , stationary points, Convex functions, point of flex, asymptote, graph of functions
5	Taylor Formula with Peano and Lagrange rest, and applications
8	Riemann Integral. Primitive function. Fundamental theorem of calculus. Integral mean value theorem. Calculus method for definite and indefinite integral.
4	Improper integrals (criteria of convergence)
2	Complex numbers (operations, representation in the plane and polar representation)
5	Numerical series (definitions, convergence, comparison tests). Unconditional convergence. .

Hrs	Practice
7	Convex fiunctions, differential calculus theorems, min/max problems and other considereations.
3	Taylor formula and applications in limit calculus.
7	Exercises about indefinite and definite integral calculus.
3	Improper integrals
4	Numerical series and convergence criteria.

MODULE
INTRODUCTORY ANALYSIS ISSUES

Prof.ssa FRANCESCA DALBONO

SUGGESTED BIBLIOGRAPHY

C. Trapani - Analisi Matematica (funzioni di una variabile reale). Edizione riveduta e corretta - 2014 - McGraw-Hill - ISBN: 9788838664397

C. D. Pagani, S. Salsa - Analisi Matematica 1. Seconda Edizione - 2015 - Zanichelli - ISBN: 9788808151339

E. Acerbi, G. Buttazzo - Primo corso di Analisi matematica - 1997 - Pitagora Editrice - ISBN: 8837109423

C. Sbordone, P. Marcellini, Analisi Matematica Uno - 1998 - Ed. Liguori - ISBN: 9788820728199

Testi di esercizi:

A. Alvino, L. Carbone, G. Trombetti, Esercitazioni di Matematica, Volume I, Parte prima - 1993 - Liguori - ISBN: 9788820719708

P. Marcellini, C. Sbordone - Esercitazioni di matematica, Primo volume, Parte prima - 2013 - Liguori - ISBN: 9788820763510

C. Trapani, R. Messina - Esercizi di Analisi uno - 2004 - Aracne - ISBN: 8879999117

AMBIT	50164-Discipline matematiche e informatiche
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56

EDUCATIONAL OBJECTIVES OF THE MODULE

The goal of this course module is to acquire the fundamentals of real analysis, the structural properties of numerical sets, the concepts of limits and continuity, the fundamental concepts in Differential Calculus, and to develop the capabilities in applying them.

SYLLABUS

Hrs	Frontal teaching
4	Basic concepts of set theory: elements of logic, basic set operations, functions, order relations. Sets of numbers: natural numbers and induction principle, integer and rational numbers, real numbers and their completeness, infimum and supremum of a set.
4	Real variable functions and their basic properties (monotonicity, symmetry, etc,), elementary functions and their inverse (trigonometric functions, exponential and logarithms, hyperbolic functions).
3	Topology of the real line (open and closed sets, adherent and accumulation points), real line intervals, numerical sequences.
7	Limits of functions and sequences; Infinitesimal and infinite, continuous functions.
4	Continuous functions on intervals: intermediate values, Weierstrass theorem, continuity of the inverse function, uniform continuity. Hints of Lipschitz and Holder continuous functions.
10	Differential calculus: derivatives (definition, interpretation, calculation of derivatives), fundamental theorems of calculus (Fermat's Theorem on stationary points, Rolle's Theorem, Lagrange's Theorem, Cauchy's Theorem, L'Hopital's Rule and their consequences).

Hrs	Practice
3	Exercises on numerical sets, on the induction principle and on real numbers
3	Exercises on elementary functions and their inversion.
2	Exercises on the topology of the real line.
8	Exercises on calculation of limits, continuous functions and their properties.
8	Exercises and comments on the notion of derivative, differential calculus and fundamental theorems of calculus.