UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2022/2023		
BACHELOR'S DEGREE (BSC)	CHEMICAL AND BIOCHEMICAL ENGINEERING		
INTEGRATED COURSE	MATHEMATICAL ANALYSIS - INTEGRATED COURSE		
CODE	19109		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	MAT/05		
HEAD PROFESSOR(S)	VETRO CALOGERO	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	VETRO CALOGERO CORSO ROSARIO	Professore Associato Ricercatore a tempo determinato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	Annual		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**CORSO ROSARIO** Tuesday 14:30 16:00 Dipartimento di Matematica e Informatica, Via Archirafi 34, studio 102, 1° piano, contattare il docente per email. **VETRO CALOGERO** Tuesday 15:00 17:00 Dipartimento di Matematica e Informatica, stanza 102, I° piano, via archirafi 34		

DOCENTE: Prof. CALOGERO VETRO

PREREQUISITES	Knowledge of numerical sets. Powers and their properties, logarithms and their properties. Fundamentals of algebra. Solving equations and inequalities of the first and second degree. Elements of analytic geometry in the plane. Fundamentals of trigonometry.
LEARNING OUTCOMES	KNOWLEDGE AND UNDERSTANDING: The student must acquire the knowledge of the language, the formalism and the basic theoretical concepts and methods of mathematical analysis. APPLYING KNOWLEDGE AND UNDERSTANDING: The student must acquire the ability of applying the techniques presented in the course in various contexts in which the mathematical analysis is required, both from the point of view of representation of mathematical models and from that of pure computation. MAKING JUDGEMENT: The student must be able to analyze and formalize a problem and identify the mathematical tools and strategies to solve it. COMMUNICATION SKILL: The student must be able to express with logical rigor, with properties of language and competence the concepts and the topics of the discipline. The student must be able to write the solution of problems in a rigorous and correct way, both in form and in substance. LEARNING SKILLS: The student must be able of using independently the acquired knowledge and must have the ability of developing advanced mathematical concepts through independent consultation of scientific texts.
ASSESSMENT METHODS	EXAMINATION: Final exam consists of a written test and an oral test. The written exam and the oral exam are evaluated out of 30/30 (each one is passed with a grade not less than 18/30) and the final vote is the average of the marks obtained in each test. The written test requires the resolution of 3/4 exercises for each module concerning the main topics covered in the course. The written test is intended to evaluate the computing capacity, the degree of knowledge of the concepts presented in the course and the ability of the students to apply them independently. The oral test consists of the discussion of the topics of the written test and of an interview on the main results presented in the course. The oral test will also allow to evaluate the acquired properties of language and reasoning skills. INTERMEDIATE WRITTEN TESTS: The written test of the exam can be replaced, only in the case of students attending the course, by two written tests that will take place at the end of each module. Precisely, each written test will be evaluated out of 15/15. If each test has a score of not less than 7.5 / 15 and the sum of the two evaluations is not less than 18/30 the student can directly support the oral exam of Mathematical Analysis, without further written exam, for a single appeal of the summer session. If the written test of a single module with a score of not less than 9/15 is passed, it is possible to pass the written test of the other module during one of the scheduled dates of exams of the summer session. If the student does not take or does not pass the written tests of the two modules, it is implicit that he will be able to take the full examination of the course (written test and oral test) during any sheduled date of exams. FINAL ASSESSMENT: The final assessment, properly graded, will be made on the basis of the following criteria: Rating: Excellent: 30-30 cum laude. Outcome: in-depth knowledge of the topics, excellent properties of language and analytical skill, the student is able to apply independently the knowledge to solve the proposed problems. Rating: Very good: 26-29. Outcome: in-depth knowledge of the topics, good mathematical language; the student is able to apply the knowledge to solve the proposed problems. Rating: Good. Rating: 24-25. Outcome: good knowledge of the main topics and properties of language, the student has a fairly good capacity to apply the knowledge to solve the proposed exercises. Rating: Satisfactory. Rating: 21-23. Outcome: basic knowledge of the main topics and sufficient command of the language, the student has a limited capacity of apply the knowledge independently, is able to solve basic exercises. Rating: Sufficient. Rating: 18-20. Outcome: acceptable knowledge of the proposed topics and acceptable command of the language, the student has a limited capacity of apply the knowledge independently, is able to solve standard exercises. Rating: Unsufficient: <18. Outcome: inadequate knowledge of the contents.
TEACHING METHODS	The course consists of two modules, Mathematical Analysis I (6 credits) and Mathematical Analysis II (6 credits), which take place respectively in the first and second semester of the first year of the degree course. Didactic activity is based

	on lectures and exercises delivered in classroom. At the end of each module there will be a written test, not compulsory but recommended, reserved to students attending the module, based on exercises similar to that proposed during the course, whose positive outcome can replace, in whole or in part, the written test of the final exam.

MODULE
MATHEMATICAL ANALYSIS - MODULE 2

Prof. CALOGERO VETRO

SUGGESTED BIBLIOGRAPHY

N. Fusco, P. Marcellini, C. Sbordone, Lezioni di analisi matematica due, Volume unico, Ed. Zanichelli, ISBN: 9788808520203.
P. Marcellini, C. Sbordone, Esercitazioni di analisi matematica due. Vol. 1 e Vol. 2, Ed. Zanichelli, ISBN: 9788808220707 (Vol. 1) e ISBN: 9788808191458 (Vol. 2).
W. Rudin, Principles of Mathematical Analysis, Third Edition, McGraw-Hill, ISBN: 9780070856133

AMBIT	50292-Matematica, informatica e statistica
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

The module aims to enable the student to acquire the analytical techniques available to solve ordinary differential equations and, as an application, to understand the idea of mathematical modeling. Moreover, it aims to let the student acquire the ability to deal with differential calculus and integrals of functions of two variables and to have a knowledge about power series. This module encourages the student to develop skill and confidence in the use of mathematical approaches in solving problems.

SYLLABUS

Hrs	Frontal teaching
3	Ordinary differential equations (ODE). General integral of an ODE. Cauchy problems.
3	Separable variable differential equations. Some real models.
3	First and second-order linear differential equations. Models.
5	Differential calculus for functions of two variables. Graphs and level sets. Limits and continuity for functions of two variables.
5	Partial derivatives. Differentiability.
3	Unconstrained and constrained optimization.
3	Double integrals.
5	Power series. Sequences and series of functions. Fourier series.

Hrs	Practice
3	Exercises and complements on the ordinary differential equations.
3	Exercises and complements on the first and second-order linear differential equations.
5	Exercises and complements on the differential calculus for functions of two variables.
5	Exercises and complements on unconstrained and constrained optimization.
3	Exercises and complements on double integrals.
5	Exercises and complements on sequences and series of functions.

MODULE
MATHEMATICAL ANALYSIS - MODULE 1

Prof. ROSARIO CORSO

SUGGESTED BIBLIOGRAPHY

M. Bramanti, C. Pagani, S. Salsa, Analisi Matematica 1, Zanichelli
P. Marcellini, C. Sbordone - Esercitazioni di Matematica Vol.1/Parte 1,2 - Ed. Liguori
C. Trapani - Analisi Matematica (funzioni di una variabile reale), McGraw-Hill

AMBIT	50292-Matematica, informatica e statistica
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

The primary goal of the module is to educate the student to the use of the main basic tools of the Mathematical Analysis, in particular the real and the complex numbers, the study of real functions of a real variable, the theory of integration and the numerical series.

SYLLABUS

Hrs	Frontal teaching
3	Sets and functions. Numerical sets and induction principle. Infimum and supremum of a numerical set.
3	Functions of a real variable and their properties. Elementary functions: exponential, logaritm, trigonometric and hyperbolic functions. Graphs of elementary functions. Elementary operations on functions.
1	Complex numbers.
1	Notes on topology of the real line. Extended line.
7	Limits of functions and main theorems. Notable limits. Continuous functions and main theorems.
7	Differential calculus and applications. Taylor's formula. Study of a function.
5	Integration theory: Riemann integral, definite integral, indefinite integral. Methods of integration. Notes about improper integrals.
4	Sequences and numerical series.

Hrs	Practice
2	Exercises about the induction principle and on the infimum and the supremum of a numerical set.
2	Exercises about elementary functions.
1	Exercises about complex numbers.
5	Exercises about limits and about continuous functions.
6	Exercises about differential calculus, the applications and the study of a function.
4	Exercises about the integration theory.
3	Exercises about numerical sequences and series.