



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2024/2025		
BACHELOR'S DEGREE (BSC)	ENERGY ENGINEERING AND RENEWABLE ENERGIES		
INTEGRATED COURSE	MATHEMATICAL ANALYSIS - INTEGRATED COURSE		
CODE	19109		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	MAT/05		
HEAD PROFESSOR(S)	DALLA RIVA MATTEO	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	DALLA RIVA MATTEO RIZZO ROSSELLA	Professore Associato Ricercatore a tempo determinato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	DALLA RIVA MATTEO Wednesday 14:30 15:30 da stabilire RIZZO ROSSELLA Tuesday 16:00 18:00 Aula di svolgimento delle lezioni		

<p>PREREQUISITES</p>	<p>In agreement with the recommendation of the European Union Council of May 22, 2018:</p> <p>Mathematical competence:</p> <p>Mathematical competence is the ability to develop and apply mathematical thinking and insight in order to solve a range of problems in everyday situations. Building on a sound mastery of numeracy, the emphasis is on process and activity, as well as knowledge. Mathematical competence involves, to different degrees, the ability and willingness to use mathematical modes of thought and presentation (formulas, models, constructs, graphs, charts).</p> <p>Essential knowledge, skills and attitudes related to this competence</p> <p>Necessary knowledge in mathematics includes a sound knowledge of numbers, measures and structures, basic operations and basic mathematical presentations, an understanding of mathematical terms and concepts, and an awareness of the questions to which mathematics can offer answers. An individual should have the skills to apply basic mathematical principles and processes in everyday contexts at home and work (e.g. financial skills), and to follow and assess chains of arguments. An individual should be able to reason mathematically, understand mathematical proof and communicate in mathematical language, and to use appropriate aids including statistical data and graphs and to understand the mathematical aspects of digitalisation. A positive attitude in mathematics is based on the respect for truth and a willingness to look for reasons and to assess their validity.</p> <p>Specifically: Standard Italian high school mathematics curriculum Algebra and arithmetics. Properties and operations of the integers, rational numbers, and real numbers. Prime numbers. The absolute value. Logarithmic and exponential functions. Integral calculus. Polynomials: operations, factorization. Quadratic and linear equalities and inequalities and reducible higher order equalities. Systems of linear equations. Equalities and inequalities involving quotients, roots, logarithmic functions, and exponentials. 2D and 3D geometry. Segments, angles, lines, planes. Classic geometric figures and their main properties, such as volumes, areas, and perimeters. Basic notions of analytic geometry. Cartesian coordinates. Lines and circles equations, as well as the equations for ellipses, parabolas, and hyperboles. Plane trigonometry. Properties of the sin and cos functions. Main trigonometric formulas for the addition, subtraction, duplication, and bisections of angles. Trigonometric equalities and inequalities. Main properties of a triangle's angles.</p>
<p>LEARNING OUTCOMES</p>	<p>Knowledge and understanding: At the end of the course students will be well acquainted with the basic elements of differential calculus for functions of one or more real variables, with the integration of real functions, and with some rudimental concepts about differential equations. More specifically, they will have a clear idea of the main global and local properties of functions and they will know and understand notions such as those of limit, continuity, derivative, antiderivative, and integral.</p> <p>Ability to apply knowledge and understanding: As a general fact, students will improve their logical reasoning and learn how to address problems in a scientifically rigorous way. In addition, they will learn how to solve problems graphically and qualitatively. More specifically, they will be able to apply calculus techniques to compute limits, study the properties of a function, compute integrals, and solve ordinary differential equations.</p> <p>Making judgements: Students will be able to argue both by analogy and by extension. Doing so they will learn how to generalize the ideas and techniques acquired in class to situations and problems that have not been explicitly addressed. They will develop the habit of considering more than one solution to the same problem, and sometimes even more than one point of view. In particular, they will start searching for original solutions. Eventually, they will become more independent in reading mathematic books and they will learn how to acquire new knowledge by themselves.</p> <p>Communication skills: Students will learn how to describe and illustrate problems related to the topics of the course. They will know how to write solutions in rigorous and correct way.</p> <p>Learning skills: As a general fact, students will learn how definitions and theorems raise from the study of specific examples (a process called "inductive logic") and, in turn, how specific cases can be studied under the light of a general theory (the so-called "deductive reasoning"). This training will be of great help when facing more advanced mathematics topics and, more in</p>

	<p>general, will lead students to the achievement of a complete autonomy and capacity of discernment, a precious toll in their engineering career.</p>
<p>ASSESSMENT METHODS</p>	<p>Written and oral test</p> <p>The written test usually contains 6-7 queries carrying a total of 30 points. Perfect test will receive honors. In the oral test student can expect two or three questions. The oral test will add up to 3/30 points to the written test score.</p> <p>To have more than 25/30 final points students have to:</p> <ul style="list-style-type: none"> - Pass the written test with more than 25/30 points - Pass the oral test with a positive outcome (anything more than or equal to 1/30 points) <p>Only students that received 25/30 or more points in the written test can take the oral test.</p> <p>If the written test is not taken in presence there will be an oral evaluation with the only reason of assessing the originality of the students' work. If the student taking the test from home will obtain more than 25/30 points he might opt for the standard oral test.</p> <p>Students might opt for one of the following options:</p> <ul style="list-style-type: none"> - taking a unique written and oral test at the end of the course - taking a written and an oral test at the end of each one of the two parts of the course <p>The rules described above apply to each one of these two solutions.</p> <p>To be admitted to the test on the second part of the course student must pass the first part test with at least 18/30 points.</p> <p>Compensatory tools and dispensatory measures will be guaranteed by the Disability and Neurodiversity Center - University of Palermo (Ce.N.Dis.) to students with disabilities and neurodiversity, based on specific needs and in implementation of current legislation.</p>
<p>TEACHING METHODS</p>	<p>We will have class lessons.</p>

**MODULE
MATHEMATICAL ANALYSIS - MODULE 1**

Prof. MATTEO DALLA RIVA

SUGGESTED BIBLIOGRAPHY

- Testo di riferimento: M. Bertsch, R. Dal Passo, L. Giacomelli, *Analisi Matematica*, seconda edizione, McGraw-Hill, Milano, 2011.
ISBN: 978-88-386-6894-4
- Eventuale libro di esercizi (facoltativo): P. Marcellini - C. Sbordone, *Esercizi di Matematica, Primo Volume Parte 1*, Liguori, Napoli, 2013.
ISBN: 978-88-207-6351-0
- Eventuale libro di esercizi (facoltativo): P. Marcellini - C. Sbordone, *Esercizi di Matematica, Primo Volume Parte 2*, Liguori, Napoli, 2017.
ISBN: 978-88-207-5252-1

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

EDUCATIONAL OBJECTIVES OF THE MODULE

Knowledge and understanding: At the end of the course students will be well acquainted with the basic elements of differential calculus for functions of one real variable. More specifically, they will have a clear idea of the main global and local properties of functions and they will know and understand notions such as those of limit, continuity and derivative.

Ability to apply knowledge and understanding: As a general fact, students will improve their logical reasoning and learn how to address problems in a scientifically rigorous way. In addition, they will learn how to solve problems graphically and qualitatively. More specifically, they will be able to apply calculus techniques to compute limits and study the properties of a function.

Making judgements: Students will be able to argue both by analogy and by extension. Doing so they will learn how to generalize the ideas and techniques acquired in class to situations and problems that have not been explicitly addressed. They will develop the habit of considering more than one solution to the same problem, and sometimes even more than one point of view. In particular, they will start searching for original solutions. Eventually, they will become more independent in reading mathematic books and they will learn how to acquire new knowledge by themselves.

Communication skills: Students will learn how to describe and illustrate problems related to the topics of the course. They will know how to write solutions in rigorous and correct way.

Learning skills: As a general fact, students will learn how definitions and theorems arise from the study of specific examples (a process called "inductive logic") and, in turn, how specific cases can be studied under the light of a general theory (the so-called "deductive reasoning"). This training will be of great help when facing more advanced mathematics topics and, more in general, will lead students to the achievement of a complete autonomy and capacity of discernment, a precious toll in their engineering career.

SYLLABUS

Hrs	Frontal teaching
3	real numbers
7	real functions
8	limits and continuous functions
8	one-dimensional differential calculus
Hrs	Practice
1	real numbers
7	real functions
10	limits and continuous functions
10	one-dimensional differential calculus

MODULE
MATHEMATICAL ANALYSIS - MODULE 2

Prof.ssa ROSSELLA RIZZO

SUGGESTED BIBLIOGRAPHY

- Testo di riferimento: M. Bertsch, R. Dal Passo, L. Giacomelli, *Analisi Matematica*, seconda edizione, McGraw-Hill, Milano, 2011.
- Eventuale libro di esercizi: P. Marcellini - C. Sbordone, *Esercizi di Matematica*, Volume I e Volume II, Liguori, Napoli, 2009.

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

EDUCATIONAL OBJECTIVES OF THE MODULE

To develop an understanding of the mathematical concepts that support engineering disciplines, such as differential calculus, the calculus of simple integrals, and ordinary differential equations.

SYLLABUS

Hrs	Frontal teaching
6	Indefinite integrals
6	Riemann integrals
6	Ordinary differential equations
10	Multivariable differential calculus

Hrs	Practice
7	Indefinite integrals
4	Riemann integrals
6	Ordinary differential equations
9	Multivariable differential calculus