UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	PHYSICS
INTEGRATED COURSE	MATHEMATICAL ANALYSIS II
CODE	13712
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	MAT/05
HEAD PROFESSOR(S)	BRANDOLINI BARBARA Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	BRANDOLINI BARBARA Professore Ordinario Univ. di PALERMO MARRAFFA VALERIA Professore Associato Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	Annual
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**BRANDOLINI BARBARA** Tuesday 10:00 13:00 viale delle Scienze, Dipartimento di Ingegneria, Edificio 8, ex Dipartimento di Metodi e Modelli Matematici, II piano, citofono 6 **MARRAFFA VALERIA** Monday 10:30 12:30 Dipartimento di Matematica e Informatica, Via Archirafi 34, studio n.221

DOCENTE: Prof.ssa BARBARA BRANDOLINI

PREREQUISITES	Contents of the course of Mathematical Analysis 1; matrix algebra, eigenvalues and eigenvectors of a matrix, diagonalization; knowledge of the space R^3.
LEARNING OUTCOMES	Knowledge and understanding The course in Mathematical Analysis 2 deal with the following arguments: differential calculus of functioms of several variables, multiple integrals, differential equations and basics of complex analysis. The aim of the course is to develop a rigorous method of reasoning and the ability to use the specific language and methods of the discipline. The learning outcomes are achieved by participating in lectures and integrative teaching activities in the classroom. The achievement of objectives is verified by the specific tests and final exams. Applying knowledge and understanding At the end of the course the student is able to solve problems of moderate difficulty and repeat rigorous proofs. Moreover, she/he can apply the learnt resolution techniques of the exercises in more general fields of Mathematics. These objectives are achieved through the completion of the demonstrations, not developed in full, and the resolution of problems of moderate difficulty regarding the topics treated during the course. Making judgements At the end of the course the students are able to develop logical arguments with a clear identification of assumptions and conclusions. They are able to recognize correct proofs, to understand mathematical models connected with concrete situations arising from other disciplines and to use the models in order to study these concrete situations. Communication skills At the end of the course the student has consolidated communication skills in written and oral presentation, both in her/his own language and in English, with logical rigor, property of language and competently. Moreover, she/he is able to mathematically formalize situations of practical interest, in industry or in economics. Lifelong learning skills At the end of the course the student shows capacity to acquire information contained in texts of Mathematics and is able to autonomously deepen the study of mathematical problems.
ASSESSMENT METHODS	The final assessment consists of a written test and an oral test. The written test consists in solving some exercises, which tend to ensure that students possess the resolution methods related to the arguments of the course. The oral exam consists of some questions about all the arguments treated during the lectures. Final assessment aims to evaluate whether the student has knowledge and understanding of the topics, he/she can prove the theorems showing property of language, mathematical rigor and reasoning skills. Both written and oral examinations contribute to the final vote. The evaluation criteria are the following. Rating: Fair. Rating: 18-21. Outcome: minimum basic knowledge of the main topics and language; the student is able to solve very elementary exercises. Rating: Good. Rating: 22-25. Outcome: Basic knowledge of the main topics, adequate property of language and limited analytical capacity; the student is able to partially apply the knowledge to solve the exercises. Rating: Very good. Rating: 26-28. Outcome: good knowledge of the topics, full ownership of language and analytical ability; the student is able to apply the knowledge to solve the exercises. Rating: Excellent. Rating: 29-30 cum laude. Outcome: excellent knowledge of the topics, excellent property of language and analytical skill; the student is able to apply the knowledge to solve the exercises.
TEACHING METHODS	Lectures and exercises in classroom. Lectures and educational activities last one academic year, but they are divided into two semesters in the second year of the course. At the end of each semester there is a written test (not compulsory), whose positive result can replace in whole or in part the final written test. Each partial written test consists into solving problems regarding the arguments studied in each semester.

MODULE
COMPLEX ANALYSIS AND DIFFERENTIAL EQUATIONS

Prof.ssa BARBARA BRANDOLINI

SUGGESTED BIBLIOGRAPHY

C. Pagani - S. Salsa, Analisi matematica 2, Zanichelli ed. (ISBN: 8808637085)
C. Trapani, Un modulo di Analisi Due, Aracne ed. (ISBN: 8879996428)
P. Marcellini - C. Sbordone, Esercitazioni di Matematica, II volume, parte prima e parte seconda, Zanichelli ed. (ISBN: 8808220702, ISBN: 8808191451)
T. W. Gamelin, Complex Analysis, Springer (ISBN: 0387950699)

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

EDUCATIONAL OBJECTIVES OF THE MODULE

The main objectives of this module are the study of differential equations, with their application to physical phenomena, and the basics of complex analysis, with their application in calssical mathematical analysis.

SYLLABUS

Hrs	Frontal teaching
6	Green's Theorem, regular surfaces and surface integrals, Stoke's Theorem, Divergence's Theorem
8	Ordinary differential equations, Cauchy problems, local or global existence and uniqueness, regularity of solutions, continuous dependence on initial conditions, integration of equation of first and second order
8	Linear ordinary differential equations, variation of parameters method. Linear ordibnary differential equations with costant coefficients: homogeneous equations, non-homogeneous equations, systems of equations
10	Functions with complex variables, holomorfic functions, the Cauchy-Riemann equations, complex integration, the Cauchy integral formula, complex power series, Taylor series, Laurent series, singularities, the residue theorem

Hrs	Practice
6	Exercises on the Green's theorem, the change of variables in multiple integrals, surface integrals, the Stoke's theorem and the divergence theorem
6	Exercises on first and second order ordinary differential equations
6	Exercises on linear ordinary differential equations and systems of linear ordinary differential equations
6	Exercises on complex variables functions, holomorfic functions, Cauchy-Riemann equations, complex integration, Cauchy integral formula, complex power series, Taylor series, Laurent series, singularities and residue theorem

MODULE DIFFERENTIAL AND INTEGRAL CALCULUS OF MORE VARIABLES *Prof.ssa VALERIA MARRAFFA*	
SUGGESTED BIBLIOGRAPHY	
Pagani, Salsa – Analisi matematica 1 – Zanichelli, edizione 2015, ISBN: 9788808151339 Pagani, Salsa – Analisi matematica 2 – Zanichelli, edizione 2015, ISBN: 9788808637086 P. Marcellini - C. Sbordone, Esercitazioni di Matematica, II volume, parte prima, Zanichelli, ISBN: 9788808220707, P. Marcellini - C. Sbordone, Esercitazioni di Matematica, II volume, parte seconda,,Zanichelli, ISBN: 9788808191458	
AMBIT	50164-Discipline matematiche e informatiche
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56
EDUCATIONAL OBJECTIVES OF THE MODULE	
Objective of the module is to deepen the knowledge of differential and integral calculus of more variable and the series of functions.	

SYLLABUS

Hrs	Frontal teaching
8	Sequences of functions: pointwise and uniform convergence. Exchange of limits; limit and derivative, limit and integral. Series of functions. Power series. Analytic functions. Fourier series .
8	Topology of R ^ n. Limits, continuity , derivability and differentiability of two or more variables. Problems of free and constrained optimization.
4	Local inversion theorem. Implicit functions, Dini theorem. Homogeneous functions.
8	Curves and integrals; linear differential forms.
4	Multiple integrals in normal domains and reduction formulas. Change of variables.

Hrs	Practice
8	Sequences of functions: pointwise and uniform convergence. Exchange of limits; limit and derivative, limit and integral. Series of functions. Power series. Analytic functions. Fourier series .
8	Topology of R ^ n. Limits, continuity , derivability and differentiability of two or more variables. Problems of free and constrained optimization.
6	Curves and integrals; linear differential forms.
2	Multiple integrals in normal domains and reduction formulas. Change of variables.