UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Economiche, Aziendali e Statistiche
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	STATISTICS FOR DATA ANALYSIS
SUBJECT	MATHEMATICS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50245-Matematico
CODE	16127
SCIENTIFIC SECTOR(S)	SECS-S/06
HEAD PROFESSOR(S)	TUMMINELLO MICHELE Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	141
COURSE ACTIVITY (Hrs)	84
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**TUMMINELLO MICHELE** Monday 14:00 16:00 Studio/Laboratorio: primo piano, ex DSSM Tuesday 14:00 16:00 Studio/Laboratorio: primo piano, ex DSSM

DOCENTE: Prof. MICHELE TUMMINELLO

PREREQUISITES	Basic knowledge of calculus, powers and their properties, logarithms and their properties, trigonometry.
LEARNING OUTCOMES	Knowledge and ability to understand: Knowledge of basic definitions and theorems of the analysis of differential and integral calculus for functions of one or more real variables. Knowledge of differential and integral calculus applications. Ability to understand the logical-deductive structure of a scientific text. Ability to apply knowledge and understanding: Ability to use the differential and integral calculus for real variable functions. Ability to represent real problems using mathematical models. Making judgments: The student must be able to evaluate and analyze the logical-deductive process of a mathematical model. The student must recognize the appropriateness of different mathematical models to solve a real problem. Communication skills: Ability to expose the consequences of the adoption of specific mathematical tools for the analysis of real problems. Learning skills: Ability to activate the logical-deductive process for analyzing and solving real problems.
ASSESSMENT METHODS	THE FINAL The final consists of a test that includes 7 exercises, 4 concerning the first unit and 3 the second unit. Students are required to complete the test in two hours. One intermediate test can be taken by the students at the end of the first teaching unit. The intermediate test includes 6 exercises that students should complete in two hours. A student passing the intermediate test is exempt from doing the exercises of the corresponding unit in the final test. In that case, the student is expected to complete the (reminder of the) final test in 1 hour. Both final and intermediate tests will be followed by a discussion of exercises. In the final test, as well as in the intermediate test (only for the corresponding topics), students will be required to make use of theorems and rules of differential and integral calculus for the analysis of functions of one or more variables. Furthermore, in some exercises, students will be required to explain and motivate all the fundamental steps of the logic process that allow them to provide a mathematical description of a given problem. ASSESSMENT CRITERIA The evaluation of the final test is based on the assessment of the following facets: i) competence; ii) ability to apply studied concepts, methods, and theorems; iii) knowledge of mathematical formalism and notation. GRADING A score ranging between 0 (insufficient) and 1 (excellent) is associated with each exercise of the final, or intermediate, test. The grade of a test, either intermediate or final, is obtained by taking the first integer larger than the product of the average score of proposed exercises and 30. The "laude" will be assigned based on the discussion of the test with the student (that also applies to intermediate tests). If a student passed the intermediate test then the final grade is obtained by taking the weighted average (0.6 for the first unit and 0.4 for the second one) of the grades received by the student for each unit. OFA According to a resolution passed by the academic senate on 13/06/2017 and a resolution passed by the CICS L41 - LM82 on 03/07/2017, passing the Mathematics exam automatically implies fulfilling the corresponding OFA.
EDUCATIONAL OBJECTIVES	OBJECTIVES OF UNIT 1: differential and integral calculus for functions of one real variable. 1) formulate and prove the fundamental theorems of differential and integral calculus for functions of one real variable; 2) use the theorems and rules of differential and integral calculus for the analysis of functions of one variable; 3) explain and motivate the steps of the logical-deductive process that allow one to represent a real problem using a mathematical model. OBJECTIVES OF UNIT 2: differential and integral calculus for functions of more than one real variable. 1) extend fundamental theorems for functions of one real variable to functions of more variables; 2) use theorems and rules of differential and integral calculus to analyze functions of more variables; 3) use the knowledge and skills developed during the course to analyze and describe real problems through mathematical models.

TEACHING METHODS	Lectures (48 hh) and in-class exercises (36 hh). The course is organized in two units: 1) differential and integral calculus for functions of one real variable; 2) differential and integral calculus for functions of more than one real variable.
SUGGESTED BIBLIOGRAPHY	UNITA' DIDATTICA 1: Funzioni di una variabile reale. Larson, Edwards. Calculus of a Single Variable – 9th Edition. Salas, Hille, Etgen. Calculus of One and Several Variables - 10th Edition. Wiley Anichini, Conti. Analisi Matematica 1. Pearson Education UNITA' DIDATTICA 2: Funzioni a piu' variabili. Edwards, Penney. Multivariable Calculus, 6.th ed., Prentice Hall. Salas, Hille, Etgen. Calculus of One and Several Variables - 10th Edition. Wiley Larson, Edwards. Multivariable Calculus, 9th ed.,Thomson Brooks/Cole. Zecca. Dispense di Analisi II. Disponibile on-line. G. De Marco, Analisi Due (vol.1), Zanichelli. Saranno inoltre messe a disposizione degli studenti delle dispense in formato elettronico preparate dal docente che riguardano tutti gli argomenti considerati nelle due unita' didattiche.

SYLLABUS

Hrs	Frontal teaching
1	Educational objectives of the course, and course organization
2	An introduction to ensembles and basic operations among ensembles. Ensemble of the parts. The product space. Partitions of an ensemble. The logic of proofs.
5	Real numbers. Neighborhood of a point. Open and closed intervals. Complex numbers. geometric and polar representation of a complex number. Power of a complex number.
3	Functions of a real variable. Plots of elementary functions. Increasing and decreasing functions. Limits.
3	Continuous functions and their properties. limits for common functions. Asymptotes.
3	Derivative of a function. Continuity and differentiability. Second, third and n-th order derivative of a real function. Derivative of elementary functions. Differentiation rules: the product rule, the quotient rule, the reciprocal rule, the generalized power rule. Local minima and maxima.
3	The de L'Hopital theorem. Sign of the derivative and locally monotonic behavior. The sign of second order derivative: convexity and and concavity.
4	Definition of Riemann integral. Main properties of the integral. The fundamental theorem of integral calculus
6	Indefinit integral and the concept of anti-derivative. Integration methods: direct, by parts, by substitution. Improper integrals.
4	Numerical series. Power series. Convergence tests. Taylor and McLaurin series.
2	Limits and continuity for multi-variable real functions. Directional derivative. Partial derivative.
4	Total differential. Linear and quadratic approximations of functions from R^n to R.
4	Local maxima and minima of functions from R^n to R. First and second order conditions.
2	Integration domains in R^n. Integral calculus of functions from R^n to R. Rectangular domains and Fubini theorem for rectangular domains in R^2.
2	Normal domains in R^2. Fubini theorem for normal domains in R^2.

Hrs	Practice
24	Limits. Optimization of functions of one real variable. Integration methods. Improper integrals. Taylor and McLaurin series.
12	Local minima and maxima of functions of two variables. Linear approximation of a function from R^n to R. Integration of functions on normal domains of R^2.