COURSE OF STUDY Sciences and management of maritime activities
ACADEMIC YEAR 2023-2024
ACADEMIC SUBJECT Mathematics

General information	
Year of the course	I
Academic calendar (starting and ending date)	13 10 2023- 27-01-2024
Credits (CFU/ETCS):	12
SSD	
Language	*Italian*
Mode of attendance	*optional*

Professor/ Lecturer	
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Telephone	
Department and address	Ionic Department in "Legal and Economic Systems of the Mediterranean: society, environment, culture"
Virtual room	*TEAMS: os5svsf*
Office Hours (and modalities: e.g., by appointment, on line, etc.)	Agreed weekly with the students with notice on the department website

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
300	*96*		*204*
CFU/ETCS			
12			

Learning Objectives	To provide students with a good foundation of theoretical, methodological and applicative skills in the fundamental areas of mathematical analysis and analytical geometry. Skills of analysis and synthesis, individual learning, problem solving, understanding and use of mathematical models of both scientific and applied interest will be developed.
Course prerequisites	Basic knowledge of algebra and analytical geometry

Teaching strategy	
Expected learning outcomes in terms of	Lectures in which the subject content is explained, with theorem demonstrations and examples. An important part is the presentation of the resolution of selected exercises in order to exemplify the theory and provide the basis for practical applications.

Knowledge and understanding on:	At the end of the teaching activities, the student must know and understand the mathematical tools illustrated during the course. The studennts must know the concepts of: o Knowledge of the definitions and theorems in the programme o Knowledge of methods for solving exercises. o Understanding of content and ability to carry out demonstrations independently. o Ability to solve problems using the course content
Applying knowledge and understanding on:	At the end of the teaching activities, the student must be able to apply the quantitative techniques learned to the solution of economic and financial problems. o Understanding of mathematical modelling methods in various fields. o Ability to solve application problems with the methods of mathematical analysis. o Ability to analyse the results obtained.
Soft skills	o *Making informed judgments and choices* At the end of the course, the student must be able to o Explain the mathematical analysis topics covered in the course, proving that they have understood the logical approach and purpose. o Demonstrate knowledge of the solution methods for solving application problems o Knowing how to model a problem using the methods of mathematical analysis, knowing how to solve the related equations and critically interpret o the results. o *Communicating knowledge and understanding* o Knowing how to clearly and rigorously present the proof of a theorem or any content learned. o Knowing how to discuss the procedure adopted to solve a problem *Capacities to continue learning* o Knowing how to research, understand and apply new contents and methods
Syllabus	
Content knowledge	1. Elements of proposition logic and predicate logic. Elements of set theory. Operations on subsets of a set, relations, functions and properties. Basic properties of natural numbers, principle of induction. Elements of combinatorics, binomial coefficients. Rational and irrational numbers. The set of real numbers and its properties. 2. Cartesian plane. Vectors in the plane, scalar product. Basics of straight line, circumference, ellipse, hyperbola, parabola. Basics of trigonometry.

	3.Real functions of real variable, restrictions, extensions, injective, suriective, bijective functions. Inverse function. Compound function. Even, odd, periodic, monotonic functions. Limited functions, not limited (inferiorly, superiorly). Extremes of a function. 4. Polynomials and properties, elementary functions, equations and inequalities. 5. Limits of real functions of a real variable, link between limits of functions, limits from left and right. Local nature of the notion of limit, uniqueness of the limit. Regularity of monotone functions. Theorem of the permanence of the sign. Comparison theorems. Theorem of forced convergence. Limit operations. Limits of elementary functions. Uncertain forms. Notable limits. Infinitesimals and infinities, orders of infinitesimals and infinities, equivalent infinitesimals and infinities. Notion of asymptote. 6. Notions of continuity at a point and in an interval. Continuity of elementary functions. Continuity of compound functions, linear combinations, the product and quotient of continuous functions. Discontinuities of I, II and III species. Theorem of zeros. Bolzano theorem. Weierstrass' first and second theorems. 7. Notion of derivative at a point and its geometrical meaning, continuity of derivable functions. Derivative of the linear combination, product, ratio of derivable functions. Derivative of the function composed of derivable functions. Derivative of the inverse of a derivable function. Derivatives of elementary functions. Relative extremes and relative extreme points of a function. Stationary points. Fermat's, Rolle's and Lagrange's theorems and consequences. Cauchy's theorem. Theorems of de L'Hospital. Monotonic and strict monotonic criteria. 8. Higher order derivatives, Taylor's formula, criteria for finding points of relative extrema. Convex functions in an interval. Points of inflection. Criterion of successive derivatives for the local study of a stationary point. Study of a function. Calculation of limits using the Taylor formula. 9. Defined Integral. Additivity and linearity of the definite integral. Comparison of integrals. Integral mean theorem. Defined integral of continuous functions at intervals. Integrability of continuous functions in an interval. Fundamental theorem and formula (Torricelli's theorem) of integral calculus. Notion of primitive. 10. Properties of the primitives of a function in an interval. Indefinite integral. Immediate indefinite integrals. Integration by decomposition into sum, by parts, by substitution. Integration of continuous and monotonic functions. Integrals in an improper sense.
Texts and readings	1) Bertsch, Dell'Aglio, Giacomelli – Epsilon 1 Primo corso di Analisi Matematica -

	Mc Graw Hill 2) Any textbook of mathematical analysis exercises
Notes, additional materials	
Repository	

Assessment	
Assessment methods	Written test with possible oral test
Assessment criteria	• Knowledge and understanding o Conscious knowledge of the definitions, theorems and proofs provided by the program. • Applying knowledge and understanding o Understanding of mathematical modelling methods, ability to use them independently in problem solving. • Autonomy of judgment o Ability to present both written and oral contents of the course, demonstrating that they have consciously acquired the fundamentals of mathematical analysis • Communication skills o Knowing how to clearly and rigorously explain the theoretical contents and approaches adopted in solving a problem. • Capacities to continue learning o Evidence of active understanding the disciplinary contents, ability to ○ accurately identify appropriate solution approaches.
Final exam and grading criteria	< 18 insufficient Fragmented and superficial knowledge of the contents, errors in applying the theoretical results in solving exercises, lack of exposure. 18 – 20 Knowledge of the contents just sufficient but general, simple exposition, uncertainties in the application of the theory in solving the exercises. 21 – 23 Appropriate but not in-depth knowledge of contents, ability to apply theoretical concepts, ability to present contents in a simple way. 24 – 25 Knowledge of content appropriate and extensive, discreet ability to apply knowledge in exercise resolution, ability to present contents in an articulated way. 26 – 27 Precise and complete knowledge of contents, good ability toa pply knowledge, analytical skills, clear and correct presentation. 28 – 29 Wide, complete and in-depth knowledge of contents, good application of contents, good ability to analyze and synthesize,

	safe and correct exposure 30 Very broad, complete and in-depth knowledge of the contents, well-established ability to solve problems using the results of The theory, excellent analysis and synthesis skills, mastery of *exposure*
Further information	
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