UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO JONICO IN "SISTEMI GIURIDICI ED ECONOMICI DEL MEDITERRANEO: SOCIETÀ, AMBIENTE, CULTURE"

General information	
Academic subject	***MATHS***
Degree course	Nautical Science and Maritime Management
Academic Year	*I*
European Credit Transfer and Accumulation System (ECTS)	12
Language	*Italian*
Academic calendar (starting and ending date)	*I year – I semester*
Attendance	*No, but attendance is strongly recommended*

Professor/ Lecturer	
Name and Surname	Fernando Carta
E-mail	Fernando.carta@uniba.it
Telephone	+393393303035
Department and address	Mariscuola Taranto
Virtual headquarters	
Tutoring (time and day)	

Syllabus	
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	*Literal calculus, solving algebraic equations and systems of algebraic equations of the second degree and special cases of degrees greater than two. Basic elements of Euclidean geometry.*
Contents	*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. Complex numbers, definitions and properties, polar representation of a complex number, n-th roots of a complex number. Vectors in Euclidean space, scalar and vector product, plane equation, line equations in space.* *3. Real successions, limit of a succession, finiteness of convergent successions, regularity of monotone successions. Limitation and monotonicity of the succession (1 + 1/n)^n, its convergence to Neper's number.* *4.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.* *5. Polynomials and properties, elementary functions, equations and inequalities* *6. Limits of real functions of a real variable, link between limits of functions and limits of successions, 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.* *7. 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.* *8. 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.* *9. 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.* *10. 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.* *11. 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.* *12. Notion of numerical series, convergence, divergence and non-regularity. Necessary condition of convergence. Harmonic and geometric series. Series with*

	terms of constant sign and with terms of definitively constant sign. Asymptotic criterion of comparison. Ratio and root criterion. Series with terms of alternate sign, Leibnitz's criterion. Numerical series and improper integrals. Series of powers.
Books and bibliography	*1) Bertsch, Dell'Aglio, Giacomelli – Epsilon 1 Primo corso di Analisi Matematica - Mc Graw Hill* *2) Any textbook of mathematical analysis exercises*
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
300	*96*		*204*
CTS			
12	*8*		*4*

Teaching strategy	*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.*
Expected learning outcomes	
Knowledge and understanding on:	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:	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	• *Autonomy of judgement* 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 the results. • *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

Assessment and feedback	

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<tr><td>Methods of assessment</td><td>Written test with possible oral test</td></tr>
<tr><td>Evaluation criteria</td><td>

Knowledge and understanding
Conscious knowledge of the definitions, theorems and proofs provided by the program.
Applying knowledge and understanding
Understanding of mathematical modelling methods, ability to use them independently in problem solving.
Autonomy of judgment
Ability to present both written and oral contents of the course, demonstrating that they have consciously acquired the fundamentals of mathematical analysis
Communication skills
Knowing how to clearly and rigorously explain the theoretical contents and approaches adopted in solving a problem.
Capacities to continue learning
Evidence of active understanding the disciplinary contents, ability to accurately identify appropriate solution approaches.

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<tr><td>Criteria for assessment and attribution of the final mark</td><td>
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<tr><th>Grade</th><th>Descriptor</th></tr>
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insufficient</td><td>Fragmented and superficial knowledge of the contents, errors in applying the theoretical results in solving exercises, lack of exposure.</td></tr>
<tr><td>18 - 20</td><td>Knowledge of the contents just sufficient but general, simple exposition, uncertainties in the application of the theory in solving the exercises.</td></tr>
<tr><td>21 - 23</td><td>Appropriate but not in-depth knowledge of contents, ability to apply theoretical concepts, ability to present contents in a simple way.</td></tr>
<tr><td>24 - 25</td><td>Knowledge of content appropriate and extensive, discreet ability to apply knowledge in exercise resolution, ability to present contents in an articulated way.</td></tr>
<tr><td>26 - 27</td><td>Precise and complete knowledge of contents, good ability toa pply knowledge, analytical skills, clear and correct presentation.</td></tr>
<tr><td>28 - 29</td><td>Wide, complete and in-depth knowledge of contents, good application of contents, good ability to analyze and synthesize, safe and correct exposure</td></tr>
<tr><td>30

30 with lode</td><td>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</td></tr>
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<tr><td>Additional information</td><td></td></tr>
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