COURSE DESCRIPTION
CALCULUS 2

SSD: ANALISI MATEMATICA (MAT/05)

DEGREE PROGRAMME: ARCHITETTURA (N14)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: CIRILLO LUCA
PHONE:
EMAIL: luca.cirillo@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: 02 Cognome A - Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 8

REQUIRED PRELIMINARY COURSES

Mathematical Analysis I

PREREQUISITES

Numerical Sets. Sequences and limits of sequences. Functions and limits of functions. Continuity. Derivability. Graph of the main elementary functions.

LEARNING GOALS

Provide the main tools of mathematical analysis for functions of two or more variables and the basic notions of probability spaces and random variables, in order to be able to use this knowledge to interpret and describe engineering problems.
In detail:
The course intends to provide the foundations of differential and

integral calculus for functions of two or more variables, differential equations and series. In particular, students will have to develop the following operational skills: understanding of the concepts and demonstrations carried out in class and ability to solve exercises on topics related to teaching.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Knowledge and understanding
Knowledge of the most commonly used mathematical fields in the various fields of Architecture: Differential calculus in one or more variables, Functions of complex variable, Linear Algebra and Analytical Geometry. These tools are acquired in the mathematical disciplines and their acquisition is verified in the related oral tests.

Applying knowledge and understanding

Ability to apply knowledge and understanding Ability to control mathematical calculation tools relevant for correct modeling of physical phenomena, demonstrations of mathematical theories and resolution of mathematical problems related to architectural design.
These skills are acquired in classroom exercises. The assessment of skills takes place through written and/or contextual tests and that of knowledge through oral exams.

COURSE CONTENT/SYLLABUS

DEFINED INTEGRALS

The definite integral: notations and definition, geometric interpretation. First properties. The mean theorem.

Properties of definite integrals:additivity, linearity, comparison of integrals. Integrability of continuous functions (s.d) .

INDEFINITE INTEGRALS

Fundamental Theorem of Integral Calculus. Primitives. Characterization of the primitives of a function in a

interval. Fundamental formula of integral calculus. The Indefinite Integral: Definition. Integration for sum decomposition. Integration of rational functions. Integration by parts. Integration by substitution.

FUNCTIONS OF TWO OR MORE VARIABLES

Introduction to the vector space IRxIR: sum of vectors, product of a vector by a scalar, modulus of a vector,

dot product, Cauchy-Schwarz inequality . Topology elements of IRxIR: circular neighborhood, interior points,

external, frontier; accumulation points, isolated points; open, closed sets; closure of a set,

domains, sets
bounded, connected sets. Limits and continuity. Weierstrass theorem (s.d.). Existence theorem of intermediate values
(s.d.). Partial derivatives. Subsequent derivatives. Hessian matrix. Schwarz's theorem (s.d.) . Gradient. Functions
differentiable. Tangent plane equation. Theorem on the continuity of differentiable functions. The theorem of
differential. Compound functions. The derivation theorem of compound functions (s.d.). Directional derivatives.
Directional derivative of a differentiable function. Functions with zero gradient in a connected. Maximums and minimums
related: Necessary condition of the first order, Necessary condition of the second order (n.d.). sufficient condition
of the second order.

DIFFERENTIAL EQUATIONS

Introduction to differential equations and the Cauchy problem. General properties of linear differential equations.
Representation of the general integral of a linear differential equation. Linear differential equations of the former
order . General integral of first order homogeneous linear equations. General integral of equations linear first order. Differential equations with separable variables. Cauchy problem for an equation first order linear differential. Homogeneous second order linear differential equations. dependent functions,
independent and Wronskian determinant. Sufficient condition for the independence of two functions (s.d.).
Characterization of the independence of two solutions (s.d.). General integral of homogeneous linear equations of
second order. Cauchy problem for a second order linear homogeneous differential equation. Characterization of the general integral of homogeneous second order linear equations with constant coefficients.

CURVILINEAR INTEGRALS AND DIFFERENTIAL FORMS IN THE PLANE

Plane curves. Parametric equations. Support of a curve. Simple curves. Closed curves. Regular curves. Length of
a curve: definition and formula for calculation. Equivalent Parametric Representations. Permissible changes
of parameter. Oriented Curves. Curvilinear abscissa. Curvilinear integral of a function. Properties of the integral
curvilinear of a function. Center of gravity of a curve. Linear differential forms. Curvilinear integral of a form
differential. Exact differential forms. Characterization of the primitives of a differential form in an open set
connected. Integration theorem of exact forms. Exact forms characterization theorem. Shapes

closed differentials. Relationship between exact and closed differential forms. Differential Shapes in a Rectangle. Open up
just connected. Theorem on closed differential forms in a simply connected open set of IRxIR.
DOUBLE INTEGRALS
Normal domains. Double integrals on normal domains. Integrability of continuous functions. Properties of the double integral:
linearity andadditivity. Reduction formulas for double integrals. First formula of the area of a normal domain
with respect to the x axis. Center of gravity of a domain. Positive orientation of the boundary of a regular domain. Formulas of
Gauss-Green in the plane. Normal unit vector outside the boundary of a regular domain. Divergence of a field
vector flat. Divergence theorem. Stokes formula. Theorem on differential forms in an open set just connected

READINGS/BIBLIOGRAPHY

The teaching material proposed in class will also be uploaded in the appropriate exam folder on the teacher's page

TEACHING METHODS OF THE COURSE (OR MODULE)

The Analysis 2 course for the A.Y. 2022/23 provides frontal lessons in modules of 3 hours each on Tuesdays and Thursdays from 2 to 5 pm in room S1.2 during the first semester, from 20 September to 12 December 2022. During the lessons, topics relating to the exam program will be introduced from time to time, taking care to recover the knowledge and prerequisites necessary for the consolidation of new concepts.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [x] Open answers
- [x] Numerical exercises

b) Evaluation pattern

The evaluation will involve aspects related to the formal and substantial correctness of both the concepts expressed and the calculations and related results proposed in the paper