Mechanical Engineering - Analisi Matematica I
Outline of the course - 12 CFU

1. **Preliminar Notions.** Axioms, sets, mappings between sets, equivalences and orders - Construction of **Z** and **Q** - Finite, infinite, countable sets - The induction principle - Elementary combinatorics - Introduction of **R** by its axioms - Construction of **R** - Infimum and Supremum - Dense subsets - Complex numbers, powers, roots, De Moivre formulas.

2. **Limits and Continuity:** Neighbourhoods, open sets, closed sets - Limits, liminf, limsup - Limits by sequences - The number e - Sequences defined by induction - Continuous functions and their properties - Zeroes of continuous functions - Continuity of elementary functions - Cauchy sequences - Compact subsets of **R** - The Weierstrass theorem - Uniformly continuous functions - Lipschitz functions.

3. **Derivatives.** Derivatives - Rules for computing derivatives of elementary functions - Local minima and maxima - Rolle, Cauchy, Lagrange, De L'Hôpital theorems - Taylor formulas - Convex functions - Qualitative analysis of a function.

4. **Integration.** The Riemann integral in one variable - Theorems on the Riemann integral - Primitives, integration by parts, changes of variables - Integration of some elementary functions - Generalized integrals - Some methods of numerical approximation of integrals.

5. **Series.** Series and their properties - Criteria of convergence for series with nonnegative terms - Absolutely converging series - Leibnitz criterium.

6. **Differential equations.** Ordinary differential equations and systems - Existence, uniqueness of solutions, domain of existence for a solution - First order equations: separable variables and linear cases - Higher order linear equations with constant coefficients - Examples of ordinary differential equations from Mechanics - Qualitative methods for nonlinear ordinary differential equations.

Giuseppe Buttazzo (the official professor of the course)