



Doctoral School of Mathematics

MATHEMATICAL ANALYSIS

- topics for admission to the PhD programme -

A. DIFFERENTIAL AND INTEGRAL CALCULUS

1. Differential Calculus on \mathbb{R}^n

- 1.1. Topology on \mathbb{R}^n
- 1.2. Differentiability on \mathbb{R}^n
- 1.3. Diffeomorphisms. Local Inversion Theorem. The Implicit Function Theorem

2. Integral Calculus of Several Variables

- 2.1. Curvilinear Integral
- 2.2. Double and Triple Integrals
- 2.3. Surface Integrals
- 2.4. Elements of Field Theory. Stokes' formulas

3. Lebesgue Integral

- 3.1. Measurable Space, Definition of a Measure, Lebesgue Measure
- 3.2. Integrable Functions. The Monotone Convergence Theorem, The Dominated Convergence Theorem
- 3.3. L^p Spaces

B. FUNCTIONAL ANALYSIS

1. Normed vector spaces. Banach spaces

- 1.1. Norm of a Vector Space. Topology of a Normed Vector Space. Completeness
- 1.2. Continuous Linear Operators. The Dual of a Normed Vector Space
- 1.3. The Hahn-Banach Theorem (Algebraic and Topologic Versions)
- 1.4. The Uniform Boundedness Principle; The Open Mapping Theorem; The Closed Graph Theorem

2. Hilbert Spaces

- 2.1. Scalar Product, Orthogonality
- 2.2. Fourier Series
- 2.3. Duality in Hilbert Spaces. The Riesz Theorem. Lax-Milgram's Theorem
- 2.4. Elements of Spectral Theory. The Fredholm Alternative

REFERENCES

1. H. Brezis, *Analyse fonctionnelle*, Masson, 1987.
2. Florescu, L.C., *Topologie. Analiză funcțională. Teoria măsurii*, Ed. Univ. "Al. I. Cuza" Iași, 1999.
3. N. Gheorghiu, *Introducere în analiza funcțională*, Ed. Academiei, București, 1974.
4. T. Precupanu, *Spații liniare topologice și elemente de analiză convexă*, Ed. Academiei, București, 1992.