Doctoral School of Mathematics

DIFFERENTIAL EQUATIONS

- topics for admission to the PhD programme -

A. ORDINARY DIFFERENTIAL EQUATIONS

1. Existence and Uniqueness for the Cauchy Problem

1.1. Existence and Uniqueness for First Order ODEs and Systems of First Order ODEs
1.2. Existence and Uniqueness for Higher Order ODEs
1.3. Peano's Existence Theorem
1.4. Global Existence and Uniqueness

2. Systems of Linear Differential Equations

2.1. Systems of First Order Linear Differential Equations
2.2. Systems of Higher Order Linear Differential Equations
2.3. Higher Order Linear Differential Equations with Constant Coefficients
2.4. Linear Differential Systems with Constant Coefficients

3. Stability Theory

3.1. Stability of Linear Differential Systems
3.2. Stability of Perturbed Linear Differential Systems
3.3. The Lyapunov Function Method

B. PARTIAL DIFFERENTIAL EQUATIONS

1. Sobolev Spaces

1.1. The H^k Spaces
1.2. Extension Theorem. Density Theorem
1.3. Imbedding Theorem
1.4. Compact Imbedding
1.5. Poincaré Inequality

2. Elliptic Boundary Value Problems

2.1. Lax-Milgram' Lemma
2.2. Existence and Uniqueness of the Dirichlet Problem
2.3. Existence and Uniqueness of the Neumann Problem
2.4. Eigenvalues and Eigenvectors of the Laplacean

3. Evolution Equations

3.1. Parabolic Equations. Existence and Uniqueness
3.2. Hyperbolic Equations. Existence and Uniqueness

REFERENCES

1. V. Barbu, *Ecuaţii diferenţiale*, Editura Junimea, Iaşi, 1985.
2. V. Barbu, Partial Differential Equations and Boundary Value Problems, Kluwer Acad. Publ., 1998.
3. H. Brezis, *Analyse fonctionnelle*, Masson, 1987.
4. I.I. Vrabie, *Ecuaţii diferenţiale*, Matrix Rom, Bucureşti, 1999.