

UNIVERSITY OF CRAIOVA
Faculty of Mathematics and Computer Science
Department of mathematics
Fundamental domain : Exact sciences
Domain: Mathematics
Master : Applied mathematics
Form : Day classes
Duration of studies : 2 years
Approved with academic year 2009-2010

Singular problems in mathematical physics

Syllabus

Course coordinator: Prof.dr. Vicentiu Radulescu

Code : MA 212

Cycle II : MASTER

Second year, Semester I, Cours 42 hours, Seminar 14 hours

Number of credits : 9

Domain : Matematics

Type : compulsory

Category : fundamental

Objectives: We develop some of the main techniques and principles in the modern nonlinear analysis, at the interplay with mathematical physics and numerical analysis. The course is conceived as a fundamental instrument and guide to do research in modern nonlinear analysis.

Necessary background: courses of partial differential equations and functional analysis

Evaluation form: Exam (E).

Contents:

A.Logistic equations

Examples. The Keller-Osserman condition. Blow-up boundary solutions. Existence and uniqueness theorems for large solutions. The asymptotic behavior of the explosive solution. The Conjecture of H. Brezis.

B.Lane-Emden-Fowler singular type equations

Elliptic equations with singular term. The Crandall-Rabinowitz-Tartar theorem. Case of convection terms. Similarities with the logistic equation.

C.Nonlinear eigenvalue problems for nonhomogeneous differential operators

Elements of spectral theory for nonlinear operators. Orlicz-Sobolev spaces. Nonhomogeneous differential operators. Concentration of the spectrum. Open problems.

Bibliography :

H. Brezis, *Analiza functionala: teorie, metode si aplicatii*, Ed. Academiei, Bucuresti, 2002 (translation from French by V. Radulescu).

M. Ghergu, V. Radulescu, *Singular Elliptic Problems. Bifurcation and Asymptotic Analysis*, Oxford Univ. Press, 2008.

V. Radulescu, *Singular phenomena in nonlinear elliptic problems*. In Handbook of Differential Equations: Stationary PDEs, vol. 4 (M. Chipot, Ed.), North-Holland, Amsterdam, 2007, pp. 483-591.

V. Radulescu, *Qualitative Analysis of Nonlinear Elliptic Partial Differential Equations*, Contemporary Mathematics and Its Applications, Hindawi, 2008