UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Partial Differential Equations

2425-1-F4001Q108

Aims

The objectives of the course are the following.

Knowledge and understanding. The student will learn some modern techniques for the analysis of PDEs, mainly of elliptic type.

Applying knowledge and understanding. By means of several examples and exercises, the student will develop the ability of applying the theorical results presented in the lectures to specific problems about PDEs.

Making judgements. The student will be able to face critically variational, minimization, and topological problems, identifying by himself/herself the most appropriate tools among those introduced in the course.

Communication skills. The student will become familiar with the appropriate language and formalism, which will make him/her able to communicate with rigor and clarity the acquired knowledge.

Learning skills. The student will be able to apply the acquired knowledge to different contexts and to examine in depth some related topics by autonomous reading of scientific literature.

Contents

- Review of some tools from real and functional analysis
- Fixed point theorems and applications.
- Approximation methods *à la* Galerkin.
- Minimization of functionals: general results, abstract theorems and compactness.
- Variational methods for finding saddle-like critical points.

Detailed program

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Prerequisites

Fundamentals of Mathematical Analysis and Functional Analysis.

Teaching form

56 hours of in-person, lecture-based teaching (8 ECTS)

Textbook and teaching resource

Reference textbook:

- H. Le Dret. *Nonlinear Elliptic Partial Differential Equations*. Springer-Verlag.

Other usefule books:

- A. Ambrosetti, G. Prodi. *A primer of nonlinear analysis*. Cambridge University Press.
- M. Badiale, E. Serra. *Semilinear Elliptic Equations for Beginners*. Springer-Verlag.
- L. C. Evans. *Partial differential equations*. Second edition. Graduate Studies in Mathematics, 19. American Mathematical Society, Providence, RI, 2010.
- O. Kavian. *Introduction à la théorie des points critiques*. Springer, 1993.
- M. Struwe. *Variational methods. Applications to nonlinear partial differential equations and Hamiltonian systems*. Fourth edition. Springer-Verlag.

Semester

Second semester.

Assessment method

Written examination. Mark out of thirty. The student is asked to develop two topics out of three proposed at the

examination in two hours. The written discussion must be precise, detailed, comprehensive and consistent with the proposed topic. Moreover it must contain some of the most significant proofs. The ability to present a selection of proofs and, above all, the critical and operational knowledge of the definitions and results presented during the course is evaluated, also by the illustration of examples and counterexamples.

Office hours

By appointment.

Sustainable Development Goals