UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Equazioni alle Derivate Parziali

2526-1-F4002Q006

Aims

1. Knowledge and understanding

At the end of the course, students will have acquired an in-depth understanding of modern techniques for the analysis of partial differential equations, with a particular focus on elliptic types. This knowledge will be grounded in advanced topics consistent with second-cycle university-level study in mathematics.

2. Applying knowledge and understanding

Students will be able to apply the theoretical results presented during the course to concrete problems involving partial differential equations. This ability will be developed through the analysis of various examples and practical exercises, encouraging both theoretical insight and problem-solving skills.

3. Making judgements

Students will develop the ability to independently and critically approach variational, minimization, and topological problems. They will be able to select and appropriately apply the most suitable mathematical methods learned during the course, even in cases where data may be incomplete or uncertain.

4. Communication skills

Through the acquisition of the appropriate mathematical language and formalism, students will be able to communicate the acquired knowledge with clarity, rigor, and coherence. They will be capable of discussing mathematical concepts effectively with both specialist and non-specialist audiences.

5. Learning skills

Students will acquire the ability to learn autonomously and continuously, applying the knowledge gained in contexts different from those presented in class. They will also be able to independently study advanced scientific texts,

thereby developing skills useful for further academic study or research activities.

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