MATH-305

Introduction to partial differential equations

Nobile Fabio

Cursus	Sem.	Type
Mathematics	BA5	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Oral
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This is an introductory course on Elliptic Partial Differential Equations. The course will cover the theory of both classical and generalized (weak) solutions of elliptic PDEs.

Content

- Laplace equation; mean value property; maximum principle; fundamental solution; Dirichlet problem and Perron's method;
- General second order linear elliptic equations; maximum principle; regularity theory in Hölder spaces;
- Variational formulation of elliptic equations; Lax Milgram theorem; existence and uniqueness of generalized solutions; regularity theory in Sobolev spaces;

Learning Prerequisites

Required courses

Analysis I-IV

Recommended courses

Measure and Integration; Functional Analysis I

Learning Outcomes

By the end of the course, the student must be able to:

- Classify different types of PDEs
- Define different notions of solutions
- Analyze the properties of solutions of PDEs
- Prove existence and regularity results of solutions of elliptic PDEs

Transversal skills

- Use a work methodology appropriate to the task.
- Demonstrate a capacity for creativity.
- Demonstrate the capacity for critical thinking

Teaching methods

Ex cathedra lectures, exercises in classroom

Assessment methods

Oral exam

Dans le cas de l’art. 3 al. 5 du Règlement de section, l’enseignant décide de la forme de l’examen qu’il communique aux étudiants concernés

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

- David Gilbarg, Niel S. Trudinger, Elliptic Partial Differential Equations of Second Order, Springer-Verlag, 2nd edition, 2001.
- Lawrence C. Evans. Partial Differential Equations, AMS-Graduate Studies in Mathematics, 2nd edition, 2010.
- Fritz John, Partial Differential Equations, Springer-Verlag, 4th edition, 1982

Moodle Link

- https://moodle.epfl.ch/

Prerequisite for

- Master courses on theory of PDEs: Equations aux dérivées partielles d’évolution (starting in AY 2020-21); Optimal Transport, Dispersive PDEs, Théorie du calcul stochastique;
- Bachelor / Master courses on numerical approximation of PDEs: Numerical Approximation of PDEs I; Numerical methods for conservation laws; Numerical methods for fluid, structures and electromagnetism; Computational finance; Numerical integration of stochastic differential equations.