

FACULTY OF SCIENCES

Faculty: Sciences

وزارة التعليم العالى والبحث العلم

Sétif 1 University-Ferhat ABBAS Faculty of Sciences Department of Mathematics

Master's Degree in in Nonlinear Analysis and PDEs

Presentation and objective of the Speciality

This training aims to provide students with useful theoretical or applied knowledge in the field of nonlinear analysis and partial differential equations, a theme that has many practical applications. At the end of the training, the student should possess and master the mathematical concepts and tools, both theoretical both theoretical and practical, enabling him to design, analyze, and implement mathematical models for engineering complex systems in the industrial or organizational system.

Admission requirements:

Bachelor's degree in Mathematics

Career Prospects/Professions:

- ✤ Prepare a doctoral thesis,
- Work in a research laboratory,
- Work in an industrial company.
- Teach in a high school (for example),

Organization of Studies and Official Duration of the Program:

Training Canvas:

- Study of functional spaces, Banach's theorem, linear operators, convergence in Banach spaces.
- Introduction to linear and nonlinear PDEs, method of separation of variables, fundamental solutions of PDEs.
- Numerical methods for solving PDEs, approximation errors, finite difference and finite element methods.
- Foundations of probability, random variables, estimation, confidence intervals, hypothesis testing.
- Introduction to scientific research, structuring a research project, writing a thesis or dissertation.

Advanced training modules:

• Study of nonlinear equations, fixed-point theorems, bifurcation and stability theories.

Program Overview:

Semester 01:

- Functional analysis method
- Optimization
- Statistics
- Complex analysis methods
- Teaching and research techniques
- English

Semester 02:

- PDEs and numerical analysis of PDEs
- Continuum mechanics
- Modeling
- Stochastic modeling
- Teaching and research techniques

Semester 03:

- Methods for solving nonlinear boundary problems
- Non-linear evolution problems
- Semi-group theory and applications to PDEs
- Control for non-linear problems
- Teaching and research techniques
- Technical English

Semester 04:

 Internship in a research laboratory or company, culminating in a thesis and defense.

Curriculum Highlights:

The Master's program in Mathematics is designed to train students in the field of nonlinear analysis and partial differential equations (PDEs) and their applications in physics.

The context of this training involves learning techniques that enable students to solve real and diverse problems in areas such as fluid mechanics, solid mechanics,

electromagnetism, thermodynamics, and hydrodynamics.

- Functional tools for the analysis of parabolic and hyperbolic problems.
- Galerkin methods, finite element methods, implicit/explicit schemes for nonlinear PDEs.
- Stochastic processes, stochastic differential equations, numerical simulations.
- Optimal control theory, controllability, constrained problems.
- Evolution equations, weak and strong solutions, long-term behavior.

Language of instruction:

French and English

Training framework:

The tables provided in the previous section "Program Overview"

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Admission Information:

The current application of Articles 171 and 1023 of Decrees:

- Skills and knowledge acquisition are assessed every six months through continuous assessment and a final exam.
- Progress from the first to the second year is automatic if the student has completed the first two semesters of the training program.
- The student's assessment focuses on, depending on the training program: lectures, practical work, tutorials, and practical internships.