People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

Sétif 1 University – Ferhat Abbas

Faculty: Sciences

Master's Degree in Applied Mathematics

Presentation and Objectives of the Specialization:

The proposed research Master's program aims to provide students with a solid academic foundation that will enable them to undertake research work in preparation for a PhD. The choice of the specialization in *Applied Mathematics* is justified by the areas of expertise present within the Mathematics Department of the University of Sétif, namely: continuum mechanics, optimization, and probability/statistics.

The goal of this proposed research Master's program is to offer students a solid education that will enable them to begin research in this broad field.

a. Admission Requirements for Graduates of the LMD System:

1. A profile that aligns with the Master's program
2. Ranking based on grade point average, with a weighting factor for students who repeated a year

b. Admission Requirements for Graduates of the Classical System:

1. A profile that aligns with the Master's program
2. No repeated years during the academic path
3. Free from any professional obligations

Career Prospects:

The program in Applied Mathematics, combined with specialization in computer science and systems security, opens up numerous career opportunities in the field of cybersecurity. Skills in modeling, data analysis, cryptography, and algorithms provide access to high-value positions in the protection of information systems.

Organization of Studies and Official Duration of the Program:

Modules de base de la formation :

- Méthodes d'Analyse Fonctionnelle
- Optimisation
- Statistiques
- Méthodes d'analyse complexe
- EDP et Analyse Numérique des EDP

Program Overview:

Semester 1:

The aim of the courses in this semester is to:

- Develop a strong command of the fundamental tools of functional analysis, understand the proofs of key results, and use them to solve various problems, particularly those arising from partial differential equations.
- Present the fundamental concepts of convex optimization.
- Provide statistical methods and the theoretical foundations necessary to solve common models in various fields such as insurance, agri-food, biology, and telecommunications systems. Practical sessions will help students become familiar with existing software tools and also create their own databases.
- Learn some methods of complex analysis.

Semester 2:

The objective of the courses in this semester is to:

- Familiarize students with numerical methods for solving partial differential equations (PDEs).
- Introduce students to the mechanics of continuous media in general, and more specifically, to fluid mechanics, elasticity, and viscoplasticity.
- Enable students to understand and formulate mathematical models in continuum mechanics and solve some problems using symbolic or numerical computation software.
- Model certain physical phenomena using fundamental types of ordinary and partial differential equations, and present some analytical and numerical solution methods for these equations.
- Study the basic concepts of numerical analysis and optimization.
- Enable students to acquire numerical and algorithmic techniques and methods for solving real-world optimization problems.
- Raise awareness among students about

• Mécanique des milieux continus
• Modélisation
• Modélisation Stochastique

•Corruption et déontologie de travail
• Méthodes Fonctionnelles et Numériques en Mécanique
• Calcul des variations et théorie du contrôle
• Recherche Opérationnelle
• Introduction aux problèmes d'évolution

Advanced training modules:

- **Fundamentals for the study of function spaces**, providing the theoretical basis for partial differential equations (PDEs) and optimization.

- **Study of deterministic methods** for convex, linear, and nonlinear optimization — essential for artificial intelligence, control systems, and cybersecurity.

- **Introduction to inferential statistics**, fundamental tools for data analysis, stochastic modeling, and machine learning.

- **Study and numerical solution of PDEs** — the core of physical modeling and computational engineering.

- **General methodology for translating a real-world problem into a mathematical model** — an interdisciplinary approach.

- **Stochastic processes, Markov chains, probabilistic models** — crucial in finance, cybersecurity, and epidemiology.

- **Study of dynamic equations** (ordinary and time-dependent partial differential equations) — foundational for physical and biological systems.

the risks of corruption and encourage them to contribute to the fight against it.

Semester 3:

The aim of the courses in this semester is to:

- Introduce students to analytical methods in mechanics.
- Provide students with foundational knowledge of classical calculus of variations and optimal control theory and their applications.
- Enable Master's students to identify a problem (related to operational research), recognize classical problems, and use appropriate solution tools.
- Study evolution problems of first and second order: variational formulation, existence, uniqueness, and regularity of solutions.
- Study abstract parabolic problems (existence, uniqueness, and approximate solution techniques).
- Examine selected examples.

Semester 4:

Semester 4 is dedicated to an introductory research project carried out in a research laboratory or a company, culminating in the writing of a thesis and an oral defense.

Curriculum Highlights:

The **Master's Degree in Applied Mathematics** is designed to train specialists capable of modeling, analyzing, and solving complex problems arising from various fields such as engineering, physics, finance, data science, and computer science. The main objective of this program is to provide students with an in-depth education in mathematics, while emphasizing their practical applications in scientific, industrial, and technological environments.

The program equips students with strong skills in numerical analysis, scientific computing, optimization, probability and statistics, and mathematical programming,

enabling them to effectively integrate into professional environments such as research centers, engineering consultancies, high-tech industries, financial institutions, or data analysis laboratories.

Moreover, this Master's program prepares students to pursue doctoral studies and to join research teams in applied mathematics, data science, or interdisciplinary fields that require advanced mathematical expertise.

Admission Information:

The current application of Articles 171 and 1023 of the decrees stipulates that:

- The acquisition of skills and knowledge is assessed every six months through continuous assessment and a final examination.
- Progression from the first to the second year is automatic if the student has successfully validated the first two semesters of the training program.
- Student evaluation, depending on the training program, covers lectures, practical work, tutorials, and practical internships.

Language of instruction:

French and English

Training framework:

The tables provided in the previous section "Program Overview"

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