

# Mathematics



ECTS credits  
5 credits



Semester  
Spring

## In brief

> **Course language:** French

## Presentation

### Prerequisites

- Analysis and Algebra corresponding to the first and second years of Bachelor of Science with major mathematics.
- An introduction to discrete probability is recommended

### Learning objectives

- Know how to mobilize and use basic mathematical approaches in other scientific disciplines
- Know how to implement numerical methods adapted to a problem
- Know how to recognize a situation involving randomness and be able to model it, be able to estimate the underlying parameters in simple cases

### Description of the programme

The course is divided into three distinct parts. The first part addresses the bases of theoretical mathematical analysis, the second part concerns scientific calculus and the last part aims to introduce the bases of probability and basic statistics.

#### 1. Theoretical Mathematical Analysis

1. Differential calculus
2. Optimisation,
3. Lebesgue Integration
4. Fourier transforms
5. Hilbert Space

#### 1. Numerical Analysis

1. Iterative Methods
2. Polynomial Approximation
3. Numerical Integration,
4. Numerical approximation of ordinary differential equations
5. Finite difference method for partial derivative equations
1. **Probability and Statistics**
  1. Basis of probability theory,
  2. Real random variables and the characterization of their distribution (characteristic function, generator function) -> orthographe à vérifier,
  3. Random variables time series (il doit y avoir un pb de traduction ou alors la version française est incorrecte) and different type of convergence,
  4. Random variables pair and random vectors
  5. Statistics : point estimates, estimation by intervals.

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## Generic central skills and knowledge targeted in the discipline

- Basics of analysis and numerical analysis, probability theory, parametric statistics.
- Know and know how to apply the main tools of Theoretical Analysis to Numerical Analysis, Probability, Statistics and in other scientific fields.
- Know how to approximate a function by numerical methods
- Know how to approach numerically the solution of ordinary differential equations and partial differential equations.
- Know the basics of Probability and know the main probability distributions
- Know the main types of convergence for sequences of random variables and know how to apply the main theorems of Probability: Law of Large Numbers, Central Limit Theorem (CLT)

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## How knowledge is tested

- CC1 - Continuous Assessment (40%): short tests, projects, lab reports
- DS1 - Final Written Exam (60%): final written exam at the end of the semester

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## Bibliography

Course handouts

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## Teaching team

- **Theoretical Analysis:** Thibaut Le Gouic (head for S5-Autumn semester and S6-Spring semester), Guillaume Chiavassa, Jean-Marie Rossi, Magali Tournus, Frédéric Schwander, Chiheb Daaloul,
- **Numerical Analysis:** Guillaume Chiavassa (head for S5-Autumn semester and S6-Spring semester), Jean-Marie Rossi, Frédéric Schwander, Magali Tournus, Chiheb Daaloul

- **Probability and Statistics:** Mitra Fouladirad (head for S5-Autumn semester), Christophe Pouet (head for S6-Spring semester), Emmanuelle Sarrouy, Magali Tournus, Frédéric Schwander, Thibaut Le Gouic, Chiheb Daaloul,

Total des heures		96h
CM	Master class	36h
TD	Directed work	36h
AA		24h

## Useful info

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### Name responsible for EU

#### Lead Instructor

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