Université Claude Bernard Lyon 1

ENS DE LYON

Advanced Mathematics
MASTER 2 IN LYON
2027–2028

Five thematic programs

- Refresher courses (late August ⇒ early September)
- Basic courses, first semester (September ⇒ December)
- Advanced courses, second semester (January ⇒ March)
- Research internship (April ⇒ July)

⇝ Internship defenses (end of August, early September)

More info on the program, applications, scholarships ... available at `mathematiques.ens-lyon.fr`

It is possible to mix courses from different thematic programs (e.g. have a "major" and a "minor" theme).

Partial differential equations and applications

Basic Courses (3 courses, 24 hours each)

- Evolution equations (Alexandre Lanar)
- Calculus of variations and elliptic equations (Pierre-Damien Thizy)
- Schrödinger operators and many-body quantum mechanics (Johannes Kellendonk, Nicolas Rougerie)

Advanced Courses (4 courses, 18 hours each)

- Fourier restriction, decoupling and dispersive PDE (Nikolay Tzvetkov)
- Reaction-diffusion equations and population dynamics (Léo Girardin)
- Introduction to optimal transport and applications (Filippo Santambrogio)
- Preservation of asymptotic limits for hyperbolic models, from continuous to numerical (Marie-Hélène Vignal)

Probability and statistics

Courses marked * are joint with the M2 program "Maths in Action". `mastermas.univ-lyon1.fr`

Basic Courses (choose 3 of 4, 24 hours each)

- Stochastic calculus (Cédric Gerbelot)
- Statistical physics (Christophe Garban)
- Concentration of measure in probability and high-dimensional statistical learning (Aurélien Garivier)
- Stochastic modeling and statistical learning* (Romain Azaïs, Nicolas Jouvin, Clément Marteau)

Advanced Courses (choose 4 of 8, 18 hours each)

- Stochastic PDEs and application to turbulence theory (Igor Honoré, Laurent Chevillard)
- Introduction to interacting particle systems (Clément Erignoux)
- Branching random walks on $\mathbb{Z}^d$ (Bruno Schapira)
- Large random matrices, large deviations, and applications (Alice Guionnet)
- Graphs and ecological networks* (Clément Marteau, Thibault Espinasse)
- Neural networks* (Cédric Gerbelot, Aurélien Garivier, Rémi Gribonval, Julian Tachella)
- Optimal transport and learning* (Filippo Santambrogio, Ivan Gentil, Yohann de Castro, Julie Digne, Nicolas Bonneel)
- Inverse problems and parsimony* (Yohann de Castro, Rémi Gribonval)

Mathematics for quantum physics

Basic Courses (3 courses, 24 hours each)

- Symplectic geometry (Leonid Ryvkin)
- Spectral analysis of Schrödinger operators (Nicolas Rougerie, Johannes Kellendonk)
- Quantum information (Guillaume Aubrun)

Advanced Courses (4 courses, 18 hours each)

- Deformation quantization (Alessandra Frabetti, Olga Kravchenko)
- Geometric quantization (Alexander Thomas)
- Semiclassical analysis (Laurent Laflèche)
- Introduction to the quantum Hall effect (Blagoje Oblak)

Groups, dynamics and geometry

Basic Courses (3 courses, 24 hours each)

- Symmetric and locally symmetric spaces (Bertrand Rémy)
- Introduction to dynamical systems (Olga Paris-Romaskevich)
- Introduction to geometric group theory (Adrien Le Boudec)

Advanced Courses (3 courses, 24 hours each)

- Measured group theory (Damien Gaboriau, Camille Horbez)
- Polish groups (Todor Tsankov)
- Analytic properties of groups (Mikael de la Salle, Nicolás Matte Bon)

Arithmetic geometry

Basic Courses (3 courses, 24 hours each)

- Introduction to schemes (Benjamin Schraen)
- p-adic fields (Laurent Berger)
- Elliptic curves (Olivier Taïbi)

Advanced Courses (3 courses, 24 hours each)

- Elliptic curves in computational number theory (Benjamin Wesolowski)
- Introduction to group schemes (Philippe Gille)
- p-adic Hodge theory (Gabriel Dospinescu)

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