Toulouse School of Economics

Master in Mathematics and Economic Decision

Program Directors: Stéphane Villeneuve and Eric Gautier

The Master in Mathematics and Economic Decision (MED) is the Toulouse School of Economics (TSE) Master's program in the field of Applied Mathematics and Statistics.

The first year is dedicated to acquiring a broad and rigorous knowledge in mathematics and statistics and presenting various topics in economics.

The second year is targeted to students interested in research-based training in Applied Mathematics and Statistics. It is offered in partnership with the Master's in Research and Innovation at University Paul Sabatier. For students aiming at a PhD. in Applied Mathematics and Statistics at TSE, this is the first year of a PhD. program in the north American system and the **first year of the doctoral program in Applied Mathematics and Statistics at TSE**. The program faculty provides assistance to these students to obtain funding and be paid for the remaining years of the PhD. The availability of courses from the departments of Economics, in particular from the doctoral track in Economics, and Computer Science allows to engage in PhD.s with a strong interdisciplinary aspect. The second year of the Master is also a good fit for a student who prefers a professional integration directly after the Master and positions requiring a strong methodological research-based training, for example as a mathematical engineer with a strong background in Economics.

Alternatively, after the first year, the students may apply to other second year Master's programs at TSE. The second year of the Master in Data Science for Social Science is particularly suited for a professional integration after the Master. Students who are interested in the PhD. in Economics may apply to the Economic Theory and Econometrics second year master.

The program is certified by ANITI, the Artificial Intelligence hub in Toulouse. Various professors hold ANITI research chairs. The hub delivers merit grants for the students and grants for the research years of the PhD.

First year– Mathematics and Economic Decision (2025-2026)

End of August refresher courses: Algebra, Probability, Econometrics, Optimization, Economics.

A course of French as a foreign language is offered for those in need.

SEMESTER 1	SEMESTER 2
Compulsory courses: • Intermediate econometrics • Probability and Statistics for Data Science • Advanced Analysis • Introduction to Convex Optimization for Machine Learning* • Computational Data Science (Python)* • FLE • Professional Development	Compulsory courses: Foundations of Machine Learning Mathematical Game Theory FLE Compulsory only if you choose the track Towards the second year of master MED below: Introduction to Nonsmooth Optimization Markov Decision Processes
Optional: **2 among 5:** • Markov Chains and applications **** • Markets and Incentives: a historical-theoretical perspective • Macroeconomics • Theory of Incentives • Market Power & Regulation **End of August refresher courses - Math Camp:** Algebra refresher *** Probability refresher *** Static Optimization refresher *** Economics Refresher *** Econometrics refresher ***	**Optional:** Towards the second year of master MED track:* (3 electives from 7) • Corporate finance • High Dimensional Data Analysis and Machine Learning • Market Finance • Martingales theory and applications**** • Stochastic Methods for Optimization and Sampling • Time series • Dynamic Optimization Econometrics and Economics Track:* (5 electives from 13) • Advanced Macroeconomics** • Advanced Microeconomics ** • Corporate Finance** • Industrial Organization ** • Market Finance** • Program Evaluation ** • Martingales Theory and Applications **** • Dynamic Optimization • Time series ** • Introduction to Nonsmooth Optimization • Stochastic Methods for Optimization and Sampling ** • High Dimensional Data Analysis and Machine Learning** • Markov Decision Processes
	Internship or Master thesis

**The student chooses to follow either the MED 2 track or the Econometrics and Economics track*
*** Masters 2 Directors recommend to attend some options:*
High dimensional data analysis and machine learning or Stochastic Methods for optimization and sampling or Time Series: M2 D3S
Industrial Organization: M2 EMO
Corporate Finance et Market Finance: M2 Finance
Time Series et Program Evaluation: M2 EEE
Program Evaluation: M2 EEE, M2 ETE
Advanced Macroeconomics: M2 ETE
Advanced Microeconomics: M2 ETE
**** Refresher courses, for TSE M1 and M2 students (read the news published on the website to know the precise dates, usually courses at the End of August)*
Courses High Dimensional Data Analysis and Machine Learning and Stochastic Methods for Optimization and Sampling are only open to the first 45 applicants.
***** To attend the Martingales theory and applications course you need to have attended the Markov Chains course first*

Second Year– Mathematics and Economic Decision (2025-2026)

SEMESTER 3 - 4

- **End of August refresher courses:** Algebra - Probability - Dynamic Optimization - Economics - Statistical Software: R - Python

Advanced courses:

- Introduction to Nonsmooth Optimization (E.Pauwels)
- Markov Decision Processes (S. Villeneuve)
- Diffusion Models in Generative AI (J. Chhor)
- Prophet Inequalities (B. Ziliotto)

Elective courses (total 24 credits):

Applied Mathematics and Statistics,
Courses by invited professors, renewed every year

An Introduction to viscosity solutions with applications in Economics (A. Davini) (3 credits)
Strategic aspects of bandit models (E. Shmaya) (3 credits)
Functional Data Analysis (D. Paindaveine) (3 credits), To be Confirmed

One course (6 credits) from Master Research and Innovation at University of Toulouse (among A4-A8, B4-B6, and C3):
https://departement-math.univ-tlse3.fr/m2ri-syllabus-2025-2026

Economics and Mathematics

- Econometrics 1 (P. Lavergne and E. Gautier) (6 credits)
- Econometrics 2 (N. Meddahi and K. Jochmans) (6 credits)
- Game Theory (A. Sanktjohanser and S.Shahanaghi) (6 credits)
- Topics in econometrics and empirical economics (6 credits)
- Optimization for Economics (D. Martimort and A. Smolin) (6 credits)
- Stochastic Optimal Control in Economics (S. Villeneuve and JP. Decamps) (6 credits)

Data Science

- Big Data : Part 1 Part 2 Part 3 (E. Gautier, M. Halford, and R. Perichon) (6 credits)
- High-Dimensional Models (E. Gautier) (3 credits)
- Nonparametric Models (A. Daouia) (3 credits)
- Optimization for deep learning (L. De Matteïs) (6 credits)
- Survey Sampling (A. Ruiz-Gazen) (3 credits)
- Mathematics of Machine and Deep learning Algorithms (E. Pauwels) (6 credits)
- Graph Analysis (M. Hoffman) (3 credits)
- Extreme Risk Analysis (A. Daouia and G. Stupfler) (3 credits)

Economics

- Economic Theory (T. Mariotti and A. Smolin) (6 credits)
- Microeconomics 1 (F. Salanié and T. Mariotti) (6 credits)
- Microeconomics 2 (P. Rey) 6 credits)
- Advanced IO (D. Jeon and P. Rey) (6 credits)
- Structural Models and Policy Evaluation (O. De Groote) (6 credits)
- Institutions and Political Economy (J. Miquel-Florensa) (6 credits)
- Contract Theory (6 credits)
- Machine Learning (3 credits)
- Topics in Econometrics (3 credits)
- Empirical and Structural Econometrics (P. Diegert) (3 credits)
- Topics in Incentive Theory: Markets and Contracts (A. Attar) (3 credits)
- Learning in Games (B. Ziliotto) (3 credits)
- Learning and experimentation (J.Hörner) (3 credits)

Finance

Capital Markets (A. Guembel and F. Declerck) (6 credits)

Corporate Finance: Theory and Empirics (U. Hege and S. Rossetto) (6 credits)

Computer Science

- Advanced Topics in Artificial Intelligence (F. Amblard, S. Cussat-Blanc, and U. Grandi) (6 credits)
- Innovative Data Management (J. Aligon and J.-M. Thevenin) (6 credits)
- Techniques du Décisionnel et Big Data (One course of your choice from UE3 Technologies du décisionnel of the Master 2 ISIADE) (3 credits)

Master Thesis or Internship

Career opportunities

The webpage of the Master details job opportunities. The program was opened in 2022-2023. All students who graduated from the two-year program and wished to pursue with a PhD got funded for the research years of their PhD. Those willing to work after the master accepted a job offer before the end of the Master (*e.g.*, at OECD).

Acceptance criteria and enrollment (details on the Admission section website: www.tse-fr.eu/admissions)

It is an international track entirely taught in English. Applicants should provide an English language certificate: TOEFL iBT 95/120 at "Best Scores", IELTS Academic 7/9 minimum or Cambridge English Advanced Certificate level C1, Home or Center Edition.

Scholarships

Some Master scholarships will be awarded to Master students according to academic and individual criteria. In addition, ANITI grants are available.

Who can apply to the first year?

- Students at TSE in Licence 3 at TSE.
- By application review: students can be granted equivalency if
  - they are able to justify a good level of mathematics and
  - are completing (or have fully completed) an undergraduate degree in Mathematics or Economics and Mathematics or Economics.

Who can apply to the second year?

- Students majoring the first year of TSE's Master in Mathematics and Economic Decision program are eligible to enroll in the M2 program.
- Or by application review:
  - students from other TSE Master's programs;
  - students from outside TSE who can justify a level of knowledge equivalent to students majoring from the first year of the MED program;

  and are willing to catch up by taking refresher courses and/or 1st year courses if necessary.

Admission process

For more details about enrollment and application process, we invite you to visit the Admission section.

Information

Administration:
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