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.

SEMESTRE 1	SEMESTRE 2
Compulsory courses: • Advanced Analysis (S. Villeneuve) • Probability and Statistics for Data Science (S. Gadat, J.-P. Ibrahim, C. Gruen) • Introduction to Convex Optimization for Machine Learning (E. Pauwels) • Computational Data Science (Python) • Intermediate Econometrics (K. Jochmans, F. Poinas) • Professional Development	Choice* between two tracks: 1. Towards MED2 2. Econometrics and Economics Students choose Track 1 if they wish to finish the program and have interest in research-based learning in Applied Mathematics and Statistics. Else Track 2 prepares them to the other masters at TSE among which the doctoral track in Economics. **Compulsory courses for tracks 1 and 2:** • Mathematical Game Theory (J. Renault) • Foundations of Machine Learning (S. Gadat, A. Daouia) **Compulsory courses for track 1:** • Markov Decision Processes (S. Villeneuve) • Introduction to Nonsmooth Optimization (E. Pauwels)
Optional: **2 among 5:** • Markov Chains and Applications (J.-P. Ibrahim) • Markets and Incentives: a Historical-theoretical Perspective (T. Mariotti) • Macroeconomics (A. Tiziana, F. Collard, P. Fève) • Theory of Incentives (A. Smolin) • Market Power and Regulation (E. Auriol)	**Optional:** **For track 1 (3 electives from 7):** • Martingales Theory and Applications (L. Miclo, S. Villeneuve) • Dynamic Optimization (B. Alziary) • Stochastic Methods for Optimization and Sampling (J. Chhor) • High Dimensional Data Analysis and Machine Learning (C. Mondon, T. Laurent) • Corporate Finance (A. Guembel) • Market Finance (S. Moinas) • Time Series (N. Meddahi) **For track 2 (5 electives from 13):** • Markov Decision Processes (S. Villeneuve) • Introduction to Nonsmooth Optimization (E. Pauwels) • Martingales Theory and Applications (L. Miclo, S. Villeneuve) • Dynamic Optimization (B. Alziary) • Stochastic Methods for Optimization and Sampling (J. Chhor) • High Dimensional Data Analysis and Machine Learning (C. Mondon, T. Laurent) • Time Series (N. Meddahi) • Program Evaluation (T. Magnac, P. Diegert) • Industrial Organization (A. de Cornière, A. Rhodes) • Corporate Finance (A. Guembel) • Market Finance (S. Moinas) • Advanced Macroeconomics (F. Collard, E. Conzalez-aguado) • Advanced Microeconomics (A. Smolin, D. Martimort)
	Internship or Master thesis

Check the webpage for the 2025-2026 program.

SEMESTER 3 - 4

End of August refresher courses: Probability, Econometrics, Static and Dynamic Optimization, Economics.

Core courses:

- Optimal Transport and Applications (A. Blanchet)
- Diffusion Models in Generative AI (J. Chhor)
- Introduction to Markov Processes in Continuous Time (L. Miclo)
- Prophet Inequalities and Mechanism Design (B. Ziliotto)
- Reading Course
  Each student is supervised by one professor and works on a graduate/research textbook and prepares a seminar presentation and manuscript on a specific aspect/result.

Elective courses:

Applied Mathematics and Statistics
- Invited Advanced Course 1: Selected Topics in Nonsmooth Optimization (G. Li)
- Invited Advanced Course 2: Bi Level Optimization (D. Salas)
- Invited Advanced Course 3: Statistical Theory of Deep Learning (J. Schmidt-Hieber)
- 1 course from the master Research and Innovation among:
  - Introduction to Optimal Mass Transport (J. Bertrand)
  - Elliptic PDEs and Evolution Problems (M. Maris)
  - An Introduction to the Theoretical and Numerical Analysis of Nonlinear Conservation Laws (F. Boyer)
  - Convergence of Probability Measures and Optimal Transport (C. Pellegrini)
  - Stochastic Calculus (S. Cohen)
  - Asymptotic Statistics (P. Neuvial, F. Bachoc)
  - From Point Processes to Hawkes Processes (M. Costa)
  - Regularity Theory for Minimizing Harmonic Maps (P. Bousquet)
  - Scientific Computing (J. Helene)
  - Branching Processes (P. Maillard, M. Pain)
  - Robust Optimization and Statistical Learning (F. Iutzeler)

Economics and Mathematics (courses of the TSE doctoral program in Economics)
- Stochastic Optimal Control in Economics (J.-P. Decamps, S. Villeneuve)
- Optimization for Economics (D. Martimort)
- Game Theory (A. Sanktjohanser, S.Shahanaghi)
- Econometrics 1 (P. Lavergne, S. Gregoir)
- Econometrics 2 (E. Gautier, K. Jochmans)
- Set Identification (C. Bontemps) and Econometrics of Unstructured and Text Data (N. Meddahi)
- Simulation Based Methods and the Bootstrap (E. Gautier, P. Lavergne)
- Econometrics of Auctions and Contracts (J.-P. Florens)
- Economic Theory (T. Mariotti, A. Smolin)
- Microeconomics 1 (F. Salanié, T. Mariotti)
- Microeconomics 2 (D. Martimort, P. Rey)
- Machine Learning in Econometrics (E. Gautier)
- Contract Theory (D. Martimort, Sara Shahanaghi)
- Markets and Contracts (A. Attar)
- Learning in Games (B. Ziliotto)
- Learning and Experimentation (J. Horner)
- Capital Markets (A. Guembel, F. Declerck)
- Corporate Finance: Theory and Empirics (U. Hege, S. Rossetto)

Data Science (courses of professionally oriented masters at TSE)
- Big Data (E. Gautier, M. Halford, R. Perichon)
- Extreme Risk Analysis (G. Stupfler, A. Daouia)
- Graph Analysis (M. Hoffman, M Keijzer)
- High-Dimensional Models (E. Gautier)
- Mathematics of Machine and Deep learning Algorithms (S Gadat)
- Nonparametric Models (A. Daouia)
- Optimization for Deep Learning (J. Bolte)
- Survey Sampling (A. Ruiz-Gazen)

Economics (courses of professionally oriented masters at TSE)
- Advanced Industrial Organizations (D.-S. Jeon, A. de Cornière)
- Structural Models and Policy Evaluation (O. de Groote, A. Gazmuri)
- Institutions and Political Economy (J. Miquel-Florensa)

Computer Science (courses at the Department of Computer Science)
- Advanced Topics in Artificial Intelligence (F. Amblard, S. Cussat-Blanc, U. Grandi)
- Business Intelligence and Big Data
- Innovative Data Management (J. Aligon, J.-M. Thevenin)

Courses from the first year (for students admitted directly in second year who did not take an equivalent course)
- Advanced Analysis (S. Villeneuve)
- Mathematical Game Theory (J. Renault)

Additional elective courses (not for credit)
- Collective Learning (C. Hidalgo)
- Statistical Software: Python
- Statistical Software: R

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
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Website: [www.tse-fr.eu]()
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2nd year Master program: Eric Gautier - [eric.gautier@tse-fr.eu]()