GENEVA GRADUATE INSTITUTE

INSTITUT DE HAUTES ÉTUDES INTERNATIONALES ET DU DÉVELOPPEMENT
GRADUATE INSTITUTE OF INTERNATIONAL AND DEVELOPMENT STUDIES

International Economics

Academic year 2025-2026

Mathematics and Statistics for Economists

EI071 - Autumn - 6 ECTS

Course Description

The aim of the course is to give the incoming Master students in Economics the necessary mathematical and statistical skills to begin the core first-year courses. We will go over linear algebra, analysis, optimisation, probability and statistics. An introduction to the different software needed, such as Latex and Stata, will also be given. This three-week course consists of daily lectures and problem-solving sessions designed to bring students from heterogeneous academic backgrounds up to speed in terms of the quantitative methods used in economics.

TEACHING ASSISTANT

Yang Jiao

Office hours

IMPORTANT

Regular attendance is compulsory, and any absence must be promptly communicated to the teacher. In the event of missing more than two sessions, students are expected to provide well-documented justifications for unforeseeable circumstances (e.g. illness, accident, death of a relative), directly to the Direction of Studies. Failure to justify absences beyond two sessions will result in the assignment of code N.

Students are also reminded of the following legal rules:

The teacher owns the **copyright** on the material they created for this course. As such, any reproduction or distribution of this document, in whole or in part, as well as of any other material created by the teacher for the course, is prohibited unless permission is granted by the author.

Recording (as video or audio) a course without the consent of the teacher and other participants is strictly forbidden.

A note on using **generative AI**:

Students are encouraged to use AI in a responsible manner. They must comply with the Institute's Rules and Good Practices for Ethical Use of Artificial Intelligence in Academic Work.

Syllabus

Pre-requisites

The material covered is at an intermediate bachelor-master level. A basic undergraduate knowledge of mathematics and statistics is of course needed, but the purpose of the course is also to refresh this knowledge, in particular for students who graduated a few years ago.

Organization

The course will be organized from Monday 18 August to Friday 5 September 2024 (3 weeks). The final exam will be on Monday 8 September.

The lectures will take place:

- Week 1 (18/08 – 22/08): mornings (from 9:00 to 12:00) and afternoons (from 13:30 to 17:30)
- Week 2 (25/08 – 26/08): mornings (from 9:00 to 12:00)
- Week 3 (01/09 – 05/09): mornings (from 8:30 to 12:00)
- Exam on Monday 08/09 – morning (from 9:00 to 11:00)
- Winter bootcamp: (dates to be announced), mornings (from 9:00 to 12:00)

Grading

Please note that a pass/fail grading system will apply for this course. The grading will be based on your participation in the course, on group work (problem sets) and on a final examination.

Content of the course (Summer)

1) Introduction to LaTeX

2) Essential Math

- Sets & elementary notation
- Functions
    - Differentiation
    - Integration
- Vectors & Matrices
    - Elementary operations & definitions
    - Rank, invertibility, determinants and eigenvalues
    - Revisiting functions
    - Revisiting differentiation

3) Optimisation Theory

- Maxima and minima
- Convexity and concavity
- Functions of several variables
- Definite and semidefinite quadratic forms
- Optimisation of multivariate functions
- Implicit relations
- Constrained optimisation
- Envelope theorem
- Inequality constraints
- Dynamic optimisation in discrete time

4) Mathematical analysis

- Homogeneous functions and Euler's formula
- Exponential and logarithmic functions
- Approximations
- Log-linearization

5) Probability and statistics

- Univariate random variables
- Multivariate random variables
- Common Probability Distributions
- Asymptotic theory
- Point estimation: Frequentist/Classical inference
- Hypothesis testing

Content of the course (Winter)

6) Integration

- Areas and integrals
- Rules of integration
- Integration by parts
- Integration by substitution
- Infinite integrals
- Differentiation under the integral sign
- Double integrals

Content of the course (Self-learn)

7) Introduction to Stata

Official Stata Beginner's Guide https://www.stata.com/links/stata-basics/

8) Introduction to R

Tutorial by Prof.Marko Mlikota https://markomlikota.github.io/software/

References:

- Carl P Simon and Lawrence Blume (1994): Mathematics for Economists
- Anton, H. (1987): Elementary Linear Algebra
- Glaister, S. (1984): Mathematical methods for economists
- Pemberton, M. and Rau, N. (2016): Mathematics for economists: An introductory textbook
- Sydsaeter K. Hammond P. and Strom A. (2012): Essential Mathematics for economic analysis.
- Hogg, McKean and Craig: Introduction to Mathematical Statistics (2018)