

## Quantitative Methods

Code: 40094  
ECTS Credits: 15

**2024/2025**

Degree	Type	Year
4313805 Economic Analysis	OB	1

## Contact

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## Teachers

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## Teaching groups languages

You can view this information at the [end](#) of this document.

## Prerequisites

There are no specific prerequisites.

## Objectives and Contextualisation

This module provides students advanced quantitative tools for economic analysis. The module covers optimization, probability and statistics.

The module is organized in two sections. The first one covers the foundations of optimization theory. The second section provides students

with the theoretical foundations of probability and statistics necessary for econometric and financial analysis.

## Competences

- Capacity to articulate basic economic theory, analytically deriving them from mathematical reasoning
- Capacity to identify basic statistical analysis and econometric techniques deriving them from the laws of probability and statistics
- Conceptually analyse a specific economic problem using advanced analytical tools

- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
- Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent

## Learning Outcomes

1. Describe statistical topics on which stochastic economic analysis and empirical analysis is based
2. Distinguish the element to be included and the necessary assumptions for proposing a decision-making problem with very simple strategic interactions
3. Framing an economic question of decision within a strategic context in simple math problem and derive its response through mathematical logic
4. Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
5. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
6. Use of mathematics to analyse economic problems

## Content

### I. Optimization

1. *Sets and Metric Spaces:*
2. *Functions and Correspondences:*
3. *Linear Spaces and Linear Algebra:*
4. *Smooth functions, Optimization and Comparative Statics:*
5. *Difference and Differential Equations:*

### II. Probability and Statistics

1. *Probability*
2. *Measure Theory*
3. *Random Variables and Distributions*
4. *Expectation*
5. *Special Distributions*
6. *Functions of Random Variables*
7. *Stochastic Processes and Limiting Distributions*
8. *Sampling*
9. *Estimation*
10. *Hypothesis Testing*

For a detailed description of the content of this module go to  
<https://sites.google.com/view/idea-program/master-program>

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory classes	112.5	4.5	1, 2, 3, 4, 5, 6
Type: Supervised			
Problem solving and tutorials	75	3	1, 2, 3, 4, 5, 6
Type: Autonomous			
Personal study, study groups, textbook readings, article readings	187.5	7.5	1, 2, 3, 4, 5, 6

The course will consist of sessions where the instructor presents the material, and sessions specifically dedicated to problem solving. Students are encouraged to form study groups to discuss assignments and readings.

The proposed teaching methodology may undergo some modifications according to the restrictions imposed by the health authorities on on-campus courses.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

### Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Class Attendance and Problem sets and assignments	20%	0	0	1, 2, 3, 4, 5, 6
Exam Part I	40%	0	0	1, 2, 3, 4, 5, 6
Exam Part II	40%	0	0	1, 2, 3, 4, 5, 6

This modul does not contemplate an evaluation from a single comprehensive exam

Exam Part I

The proposed evaluation activities may undergo some changes according to the restrictions imposed by the health authorities on on-campus courses.

Exam Part II

40%

Problem sets and assignments + Class attendance and active participation

20%

Optimization:

Axler, S.J., Linear algebra done right (Vol. 2). New York: Springer.  
 Carter, M., Foundations of mathematical economics. MIT Press.  
 Sydsæter, K., Hammond, P., Seierstad, A. and Strom, A., Further mathematics for economic analysis. Pearson education

#### Probability and Statistics:

Ash, R.B., Real Analysis and Probability, Academic Press.  
 Bierens, H.J., Introduction to the Mathematical and Statistical Foundations of Econometrics, Cambridge University Press.  
 Billingsley, P., Probability and Measure, Wiley.  
 DeGroot, M.H. and Schervish, M.J., Probability and Statistics, Pearson.  
 Hogg, R.V., McKean, J. and Craig, A.T., Introduction to Mathematical Statistics, Pearson.  
 Lindgren, B.V., Statistical Theory, Chapman and Hall/CRC.  
 Rice, J.A., Mathematical Statistics and Data Analysis, Cengage Learning.

Additional references will be provided during the course.

#### Software

- Matlab
- R
- Python
- Stata

#### Language list

Name	Group	Language	Semester	Turn
(PLABm) Practical laboratories (master)	30	English	first semester	morning-mixed
(TEm) Theory (master)	30	English	first semester	morning-mixed