

**Quantitative Methods**

Code: 40094  
ECTS Credits: 15

Degree	Type	Year	Semester
4313805 Economic Analysis	OB	1	1

**Contact**

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**Use of languages**

Principal working language: english (eng)

**Teachers**

Jordi Caballé Vilella  
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**Prerequisites**

There are no specific prerequisites.

**Objectives and Contextualisation**

This module provides students advanced quantitative tools. These tools are necessary for economic analysis.

This module covers optimization, probability, statistics and game theory. The module is organized in three sections. The first section 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.

The third section is devoted to game theory; it provides the student with the mathematical framework that is necessary to analyze multi-person decision theory problems.

**Skills**

- 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

### Optimization

1. Topology
2. Continuity
3. Differentiability
4. Convexity
5. Static Optimization
6. Dynamic Systems

### Probability and Statistics

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

## Methodology

- Theory classes
- Practice classes
- Learning based on problem solving
- Tutorials
- Personal study
- Study groups
- Textbook reading
- Article reading

## Activities

Title	Hours	ECTS	Learning outcomes
<b>Type: Directed</b>			
Theory classes	112.5	4.5	1, 2, 3, 4, 5, 6

**Type: Supervised**

Problems sets, tutorials	112.5	4.5	1, 2, 3, 4, 5, 6
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**Type: Autonomous**

Personal study, study groups, textbook readings, article readings	150	6	1, 2, 3, 4, 5, 6
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**Evaluation****Evaluation activities**

Title	Weighting	Hours	ECTS	Learning outcomes
Class Attendance and Problem sets and assignments	20%	0	0	1, 2, 3, 4, 5, 6
Final Exams	80%	0	0	1, 2, 3, 4, 5, 6

**Bibliography**

- De la Fuente, Angel: Mathematical methods and models for economists. Cambridge University Press, 2000.
- Ok, Efe A.: Real analysis with economic applications. Princeton University Press, 2007
- 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, John Wiley.
- DeGroot, M.H., Probability and statistics. Addison-Wesley.
- Hoel, P.G., Introduction to mathematical statistics. John Wiley.
- Hogg, R.V. and Craig, H., Introduction to mathematical statistics. McMillan.
- Lindgren, B.V., Statistical theory. McMillan