VNIVERSITAT DE VALÈNCIA

COURSE DATA

Data Subject	
Code	44943
Name	Quantitave Methods
Cycle	Master's degree
ECTS Credits	5.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
2242 - M.D. in Economics	Faculty of Economics	1	First term

Subject-matter

Degree	Subject-matter	Character
2242 - M.D. in Economics	1 - Instrumental matter	Obligatory

Coordination

Name	Department
BRETO MARTINEZ, CARLES	10 - Economic Analysis
ROCHINA BARRACHINA, MARIA ENGRACIA	132 - Economic Structure

SUMMARY

Optimization Theory is an indispensable tool in Economics. Many problems making economic use of it, allowing its mathematical modelling and thus, offering solutions of them. Both decision-making processes that are studied in economics, like most of analysis tools (statistical and econometric) data used in it have as one of the tools in which base their theoretical and analytical foundations Optimization. Thus, to analyze the behavior of the various economic agents in an economy it is assumed that these agents exhibit some kind of rational behavior or preferences optimizer (See for example, the analysis of the behavior of consumers or consumer theory businesses in the Theory of Production). Moreover, the use of statistical procedures and econometrics, to analyze the economic, seeks to obtain good estimates the relationships between different economic variables, based estimators. They met, or rather optimize, certain properties (for example, the estimators least squares or maximum likelihood). In these, and in many cases not directly related to the Economics Theory Optimization is a basic analysis tool that allows the use of Mathematics in Social Sciences.

In this sense, the subject Optimization for Economic Analysis has a character introductory, focusing on static analysis models, but seeks to offer students, a clear and yet so precise, the fundamentals of the

theory of optimization as a tool basic in the analysis, study and development of economic models. For this purpose, we intend that the knowledge acquired in this course are useful as follows:
1. First, providing the basic knowledge that any future graduate in Economics Mathematical Optimization must possess, so that this knowledge will allow understand and successfully address both economic models and analysis tools Data that are studied in different subjects that make up this level, especially those related to Economic Analysis (Microeconomics, Macroeconomics, Statistics and Econometrics) and have a minimum of theoretical knowledge that will help you address the problems they may face in their professional lives.
2. Secondly, serving as a starting point for the study of materials that develop these tools in other environments and mathematically modelled decision in different environments, such as Dynamic Optimization, Multi-Criteria Decision, Game Theory, Computer Economics... subjects taught in higher degree courses or graduate.

Summarized in a way we could say that the subject deals with the study of theory Mathematical Programming Optimization or from a static and multivariate environment. In this sense, his study begins with an introduction to the problem of static optimization including a basic reminder of both elements and the concepts topology and properties. Theory of Convexity necessary to address the matter. After this introduction to the problem and its basics, care for minor problems is provided, those in which the variables. They can take any value, ie, unconstrained optimization, allowing us to settle the basis for a study of more complex problems, such as those optimization problems in which we introduce constraints on the values that can take the variables. These problems analyzed under the terms Optimization with equality and inequality constraints, depending on the type of entering restriction analysis. The course provides an introduction to deterministic and stochastic dynamic programming. The dynamic programming is the most important to solve many optimization problems. Dynamic programming is characterized by three types of equations namely:
1. initial conditions
2. a recursive relation and
3. an optimal value function.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The issues raised in the previous section will be solved with the maximum possible analytical rigor. Therefore, we must realize that the knowledge acquired in other courses in the program, basically Mathematics (linear algebra, differential equations, basic function analysis), Microeconomics, Macroeconomics, constitute usually the benchmark used during the course.

OUTCOMES

2242 - M.D. in Economics

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.

LEARNING OUTCOMES

1- Students can apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.

2- Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences, clearly and unambiguously.

3- Gain the capacities of abstraction and logical reasoning that are essential for the creation of economic models: ability to express oneself using formal, graphic and symbolic languages, to apply analytical and mathematical methods to economics, and to relate and manipulate concepts according to a purpose.

4- Acquire linguistic and technological skills: ability to use English in the scientific field of economics and to use ICT in the field of economic study and research.

5- Know how to properly use econometric techniques applied to the analysis of the functioning of the economy.

DESCRIPTION OF CONTENTS

1. Quantitative Methods

Topic 1. Basic Linear Algebra
Basic operations. Matrix types. Determinant and inverse matrix. Positive definite matrices. Linear equation systems. Matrix diagonalization.

Topic 2. Optimization in Rn
Optimization problems in parametric form. Optimization problems: Some examples. Unconstrained Optimization Gradient. Maximum and minimum. Global optima. Constrained Optimization. Convex structures in optimization theory.

Topic 3. Continuous time: First and higher order differential equations
1. First-order linear differential equations with constant coefficient and constant term.
2. Dynamics of marketplace.
3. Variable coefficient and variable term.

4. The dynamic stability of equilibrium.

Topic 4. Introduction Dynamic Programming
1. Discrete time deterministic models.
2. Continuous time deterministic models.
3. Discrete time stochastic models.
4. Continuous stochastic models.

Topic 5. Deterministic Dynamic Programming
1. Discrete time. Representative agent problem. The Ramsey Problem.
2. Continuous time. Representative agent problem. The Ramsey Problem.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	40,00	100
Classroom practices	10,00	100
Study and independent work	75,00	0
TOTAL	**125,00**	

TEACHING METHODOLOGY

The students first engage the content online (through readings, video lectures, or podcasts), then come to class for the guided practice. It requires explicit communication of learning objectives, procedures, roles, and assessment criteria. Second, the student uses the time class in order to practice the knowledge learning acquire in the previous step. In this setting, the role of the teacher is founded to train the students to learn the main concepts of this subject.

EVALUATION

The grade of the theory and practice can be obtained through submission of assignments that will be raised during the development of the course (50% of the mark). Specifically, can be achieved through the delivery of exercises that will be proposed during either the theoretical lectures or the tutorials. Some of these exercises are planned to be solved and delivered in lectures. At the end of this course, the students will take an exam on the official date and it will represent the remaining 50% of the mark.

REFERENCES

Basic

-

- Alpha C. Chiang (1984): Fundamental methods of mathematical economics. McGraw-Hill.

- Alpha C. Chiang (2000): Elements of Dynamic Optimization. Waveland Press.

- Akira Takayama (1994): Analytical methods in Economics. Harvester, Hertfordshire.

- Gerhard Sorger (2015): Dynamic economic analysis: deterministic models in a discrete time. Cambridge University Press.

- Nancy L. Stokey, Robert E. B. Lucas, Edward C. Prescott (1989): Recursive Methods in Economic Dynamics. Harvard University Press.

- Rangarajan K. Sundaram (1996): A first course in optimization theory. New York University.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

This academic guide might need to be modified in order to adapt to the evolution of the ongoing Covid-19 pandemic. Since this evolution is uncertain as of today, any required change in teaching methodology and evaluation will be announced in due time. Such changes will be proportionate to any restrictions imposed on the university.

In case of lockdown, teaching methodology will likely move to either a fully on-line or a hybrid system.

In case of lockdown, evaluation will be changed as little as possible from its description in the academic guide. Such changes will likely involve protocols for appropriate online communication via the available platforms.