

Mathematical Economics
Economía Matemática - Maestría
Universidad del Rosario - Facultad de Economía
Semestre 2012 - II
Syllabus

Instructor: Çağatay Kayı.

Class Hours: Mondays & Thursdays: 15:00 - 17:00.

Lecture Hall: Auditorio I, Pedro Fermin.

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Office Hours: Mondays: 13:00 - 15:00. Otherwise, please e-mail me to arrange a mutually convenient time.

Objectives: This course is aimed for students in the Master of Economics. The purpose of the course is to provide some basic mathematics tools used in economics research. At the end of the course, students are able to deal with mathematical structures behind economic models and solve problems of static and dynamic optimization, and differential equations.

Requirements: There are lectures (twice a week) and a problem session (every two weeks, starting from second week during (or after) the lectures). Evaluation is based on two partial exams (25% each), quizzes (20%) and a final exam (30%). There are problem sets that you do not have to hand them in but these problems are good preparation for the exams. The final is cumulative. There is an objection period after each exam for a week. If a student misses an exam, we follow the regular procedure determined by the academic regulations. There are NO make-up exams without documented medical evidence that should be presented within one week of the exam. Failure to do so results in a score of zero on the missed exam. After the final, there is no rounding for grades and the grades are not subject to change unless there exists a well-founded claim.

The schedule is as follows:

- *First day of classes:* 2 August 2012, Thursday.
- *First exam:* 6 September 2012, Thursday.
- No classes on August 20, October 15 and 18 (Semana Rosarista), November 5 and 12.
- *Second exam:* 11 October 2012, Thursday.
- *Last day of classes:* 22 November 2012, Thursday.
- *Final:* 22 November 2012, Thursday.

Course Outline:

1. Mathematical Preliminaries
 - (a) Mathematical Logic and How to Write a Proof.
 - (b) Sets.
 - (c) Matrices, Sequences and Functions.
 - (d) Homogeneous functions and the Euler Theorem.
 - (e) The Implicit Function Theorem and the Inverse Function Theorem.
 - (f) Quadratic Forms.

2. Optimization in \mathbb{R}^n .
 - (a) Existence of Solutions: Weierstrass Theorem.
 - (b) Unconstrained Optimization.
 - (c) Equality Constraints and Theorem of Lagrange.
 - (d) Inequality Constraints and Theorem of Kuhn and Tucker.
 - (e) Convex Structures in the Optimization Theory.
 - (f) Quasi-Convexity and Optimization.
 - (g) Convex Sets and Separating Hyperplanes.
 - (h) Envelope Theorem.
3. Correspondences.
 - (a) The Theorem of Maximum.
 - (b) Fixed Point Theorems (Brouwer, Kakutani, and Tarsky).
4. Metric Spaces.
 - (a) Cauchy Sequences and Completeness.
 - (b) Contraction Mappings and the Contraction Mapping Theorem.
 - (c) Uniform Convergence, Pointwise Convergence, and the Uniform Convergence Theorem.
5. Difference Equations.
 - (a) First-order linear difference equations and system of linear difference equations.
 - (b) Second-order linear difference equations.
 - (c) Stability of solutions.
6. An Introduction to Dynamic Optimization.
 - (a) Dynamic Programming: Sequential Problem and Functional Equational Problem.
 - (b) Bounded Returns and Euler Equations.
 - (c) The One Sector Model of Optimal Growth.
7. An Introduction to Measure Theory
 - (a) Event Spaces.
 - (b) Borel σ -algebras and Probability Spaces.
 - (c) Probability Measures and Random Variables.

Suggested Readings:

- Ok, E.A. (2007) Real Analysis with Economics Applications, Princeton University Press.
- Sundaram, R. (1996) A First Course on Optimization, Cambridge University Press.
- Stokey, N. L. and Lucas, R.E. (1989) Recursive Methods in Economic Dynamics, Harvard University Press.
- Escobar D. (2005) Economía Matemática, Ediciones Uniandes, Alfaomega Bogotá, Colombia.