

Mathematical Economics
Economía Matemática - Maestría
Universidad del Rosario - Facultad de Economía
Semestre 2011 - II
Syllabus

Instructor: Çağatay Kayı.

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

Lecture Hall: Auditorio I, Pedro Fermin.

Email: cagatay.kayi@gmail.com, kayi.cagatay@urosario.edu.co.

Office: La Buhardilla 207.

Office Hours: 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 will be lectures (twice a week) and a problem session (once a week, starting from second week during (or after) the lectures). Evaluation will be based on two partial exams (25% each), quizzes (20%) and a final exam (30%). There will be problem sets. These problems and the questions in the suggested readings are good preparation for exams. The final will be cumulative. There will be objection period after each exam for a week. If a student misses an exam, we will follow the regular procedure determined by the academic regulations. There will be NO make-up exams without documented medical evidence that should be presented within one week of the exam. Failure to do so will result in a score of zero on the missed exam. There will be informal arrangements in this regard. 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 2011, Tuesday.
- *First exam:* 8 September 2011, Thursday.
- No classes on 11 October and 13 October 2011.
- *Second exam:* 27 October 2011, Thursday.

- *Last day of classes:* 24 November 2011, Thursday.
- *Final:* 24 November 2011, 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. Differential Equations.

- (a) Existence of Solutions.
 - (b) Uniqueness of Solutions.
 - (c) System of Differential Equations.
6. An Introduction to Dynamic Optimization.
- (a) Dynamic Programming: Sequential Problem, Functional Equational Problem(Bellman's Equation), Euler Equation.
 - (b) Calculus of Variations.
 - (c) Optimal Control: Pontryagin's Maximum Principle.
7. An Introduction to Measure Theory
- (a) Event Spaces.
 - (b) Borel σ -algebras and Probability Spaces.
 - (c) Probability Measures and Random Variables.

Suggested Readings:

- Arrow K., Intriligator M. (1981) Handbook of Mathematical Economics, Volume I, North-Holland Publishing Company.
- Ok, E.A. (2007) Real Analysis with Economics Applications, Princeton University Press.
- Sundaram, R. (1996) A First Course on Optimization, Cambridge University Press.
- Rochet, J-C. Dynamic Optimization in Continuous Time. Forthcoming.
- Escobar D. (2005) Economía Matemática, Ediciones Uniandes, Alfaomega Bogotá, Colombia.