

MATH-S-400 Mathematical and economic modeling

Syllabus

Professor: Thomas Demuynck

1 Course description

The main goal of this course is to provide with some necessary mathematical skills to pursue more advanced courses in economics. The course is devised to improve the technical skills in the areas of (real) analysis and fixed points which are used in many of the sub-disciplines of economics.

This document contains some relevant information to study the course Mathematics and Economic Modeling (aka Topics in Mathematics). Firstly it lists some background references that can be useful to refresh the mathematical concepts that a bachelor in economics should master. Secondly, it provides a short description, with corresponding motivation, of the selected topics. Finally, it gives a timetable when the different lectures are taking place.

Course Information

- Title: Mathematics and Economic Modeling
- Code: MATH-S400
- Credits: 5ECTS
- Teaching language: English
- Course website: <http://mathecosolvay.com>
- Exam
 - Written exam: 90%
 - Assignments: 10%

Prerequisites

The students are assumed to be familiar with mathematical subjects taught in the first two years of the bachelor in economics at the Université libre de Bruxelles; i.e.

Mathématique générale: analyse et algèbre linéaire (MATH-S101) and *Mathématique: fonctions de plusieurs variables* (MATH-S201). Below I list some background references that can be used to refresh this material.

- Chiang, A.C and K. Wainwright, “*Fundamental Methods of Mathematical Economics*” Economic series, McGraw-Hill.
- Gassner, M. “*Mathématique générale*”, first year course.
- Gassner, M. “*Mathématique: fonctions de plusieurs variables*”, second year course.
- Luderer, B., V. Nollan and K. Vettters, “Mathematical Formulas for Economists”, Springer, New Yor (www.springerlink.com)
- Simon, C.P. and L. Blume, “*Matématiques pour économistes*”, ouvertures économiques, De Boeck Université.
- Simon, C.P. and L. Blume, “*Mathematics for Economists*”, Norton & Company, New York.
- Sydsaeter, K., A. Strom and P. Berck, “*Economists’ Mathematical Manual*”, Springer, New York (www.springerlink.com)

Topics

- Logic and Proofs: first order propositional logic, truth tables, direct proof, proof by contrapositive, proof by contradiction, proof by induction
- Sequences and limits
- Extreme and intermediate value theorem
- Correspondences
- Berge’s maximum theorem
- Convexity
- Contraction mappings
- Sperner’s lemma
- Brouwer’s fixed point theorem
- Kakutani’s fixed point theorem
- The existence of a Nash equilibrium.

2 Course material

The course makes use of lecture notes and exercises. These are free to download from the course website. Students may want to consult following handbooks for additional material.

- Michael Carter, 2001, **Foundations of Mathematical Economics**, The MIT Press; Cambridge, Massachusetts London, England.
- Alpha C. Chiang and Kevin Wainwright, 2016, **Fundamental methods of Mathematical Economics**, McGraw-Hill Global Education Holdings, LLC.
- Carl P. Simon and Lawrence Blume, 1994, **Mathematics for Economists**, W.W.Norton & Company, New York, London.
- Knut Sydsaeter, Peter Hammond, Atle Seierstad, Arne Strom, 2005, **Further Mathematics for Economic Analysis**, Prentice Hall.
- Rakesh Vohra, 2005, **Advanced Mathematical Economics**, Routledge, London, New York.

3 Course time table

week	Tuesday	time	Friday	time
1	Sept 17,	12:14	Sept 20,	13:16
2	Sept 24,	12:14	Sept 27,	13:16
3	Oct 01,	12:14	Oct 04,	NC
4	Oct 08,	NC	Oct 11,	10:13
5	Oct 15,	NC	Oct 18,	10:13
6	Oct 22,	12:14	Oct 25,	10:13
7	Oct 29,	12:14	Nov 1	NC
8	Nov 05,	12:14	Nov 08,	10:13
9	Nov 12,	12:14	Nov 15,	10:13
10	Nov 19	12:14	Nov 22,	10:13
11	Nov 26,	12:14	Nov 29,	10:13
12	Dec 03,	12:14	Dec 06,	10:13
13	Dec 10,	12:14	Dec 13,	10:13
14	Dec 17,	12:14	Dec 20,	10:13

NC: no class