

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.

Due to covid measures, this timetable may be up to change.

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. Velters, “Mathematical Formulas for Economists”, Springer, New York (www.springerlink.com)
- Simon, C.P. and L. Blume, “*Mathématiques 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 15,	12:14	Sept 18,	13:16
2	Sept 22,	12:14	Sept 25,	NC
3	Sept 29,	12:14	Oct 02,	13:16
4	Oct 06,	12:14	Oct 09,	10:13
5	Oct 13,	12:14	Oct 16,	10:13
6	Oct 20,	12:14	Oct 23,	10:13
7	Oct 27,	12:14	Oct 30,	10:13
8	Nov 03,	12:14	Nov 06,	10:13
9	Nov 10,	12:14	Nov 13,	10:13
10	Nov 17,	12:14	Nov 20,	NC
11	Nov 24,	12:14	Nov 27,	10:13
12	Dec 01,	12:14	Dec 04,	10:13
13	Dec 08,	12:14	Dec 11,	10:13
14	Dec 15,	12:14	Dec 18,	10:13

NC: no class