

Math for Business and Econ

(Department of Economics, HKUST)

ECON 5100, Fall 2023

Classroom: Lecture Theater C
Class Date: TU/TR
Class Time: 9:00 – 11:50am
Duration: Sept 05 – Oct 19

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1. Course Description

This course introduces several branches of mathematics, which are necessary for postgraduate studies in economics. It is intended as a general introduction with emphasis on optimization. It will have: a quick coverage of matrix, a brief introduction of real analysis, a detailed introduction of general optimization, a good coverage of dynamic optimization, and, if time permits, an introduction of ordinary differential equations. Students are required to have basic knowledge of mathematics and understand intuitively some main math results and approaches, with minor requirement on the skills of logical proofs and derivations.

Intended Learning Outcomes

- This course introduces several branches of mathematics, which are necessary for postgraduate studies in economics.
- It is intended as a general introduction with special emphasis on optimization and matrix analysis.
- It will have: a good coverage of matrix, a brief introduction of real analysis, a detailed introduction of general optimization, a good coverage of dynamic optimization, and, if time permits, an introduction of ordinary differential equations.
- Students are required to have basic knowledge of mathematics and understand intuitively some main math results and approaches, with minor requirement on the skills of logical proofs and derivations.

Teaching Approach

This course introduces several branches of mathematics, which are necessary for postgraduate studies in economics. It is intended as a general introduction with special emphasis on optimization and matrix analysis. In class, I will display slides, which contain the crucial information (results and definition). I will also derive the models and proofs step by step. If necessary, I will also draw relevant graphs step by step.

2. Resources

The Main Textbook

Wang, S. (2008). *Math in Economics*. People University Publisher, \$30, In our library and bookstore, HB135 W356. Not in reserve.

Supplement Textbooks

Sydsæter, K., et al. (2005). *Further Mathematics for Economic Analysis*. Prentice Hall, in library reserve. The solution manual is at course website.

Chiang, A.C. (1984). *Fundamental Methods of Mathematical Economics*. McGraw-Hill, in library reserve. The solution manual is at course website.

Greene, W.H. (1993). *Econometric Analysis*. Maxwell Macmillan, at our course website.

Kamien, M.I., Schwartz, N.L. (1981, 1991). *Dynamic Optimization*. North Holland, in library reserve and at our course website.

Sargent, T.D. (1987). *Dynamic Macroeconomic Theory*. Harvard University Press, in library reserve and at our course website.

Takayama, A. (1993). *Analytical Methods in Economics*. University of Michigan Press, in library reserve and at our course website.

3. Course Outline

Topics

Chapter 1 (1.5 lectures). Linear Algebra: vector, matrix, determinant, inverse matrix, matrix operations, eigenvalue and diagonalization, linear equation system, elementary operations, rank and trace, symmetric matrix, block matrix, pseudo inverse, idempotent matrix. References: Sydsæter (2005, Chapter 1) and Greene (1993, Chapter 2).

Chapter 2 (0.5 lecture). Math Analysis: set, logic, functions, sequences, limit, continuity, differentiation, homogeneous functions, fundamental theorems. References: Sydsæter (2005, Chapters 2, 13, 14, and Appendix A) and Chiang (1984, Chapters 6, 7, 8).

Chapter 3 (4 lectures). General Optimization: definite matrix, concavity, quasi-concavity, Extreme-Value Theorem, unconstrained optimization, constrained optimization, Envelope Theorem. References: Sydsæter (2005, Chapters 2, 3) and Chiang (1984, Chapters 9, 11, 12, 21).

Chapter 4 (4 lectures). Dynamic Optimization: discrete-time stochastic programming, continuous-time deterministic programming, phase diagram. References: Sydsæter (2005, Chapters 8, 9, 10, 12).

Course Prerequisites

This course assumes that you have the knowledge of calculus and some basic knowledge of linear algebra. Wang (2008), Sydsæter (2005) and Chiang (1984) are most useful. But, you don't really need any of the listed books.

Arrangement

Problem Sets: There is one problem set for each chapter. No need to hand in. Answers are provided.

Exams: There are a midterm exam held on Oct 03 and a final exam held on Oct 19; both exams are scheduled at the class meeting time.

Grading Policy

The midterm exam counts for 30% and the final exam counts for 70%. The final exam is not accumulative. There is no make-up for the midterm exam. In case that you have a valid excuse for missing the midterm exam, you will be given some extra problems in the final exam which correspond to the midterm exam coverage. Illness is taken as a valid excuse only if a doctor indicates by a written note that illness affects you to take the exam. Refer to the University's policy for validity of other excuses..

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