Instructor
Bo Chen
Email: bochen@ust.hk
Office: LSK 6083A

Time and Location
MW, 9:00AM - 11:50PM, LSKG 012
Duration: September 02 - October 16

Course Webpage HKUST Canvas (Lecture Notes and Homework Assignments).

Office Hours
Tuesday: 2:00pm - 3:00pm, LSK 6083A

Course Description

This course is designed to equip you with the essential mathematical tools used in microeconomics, macroeconomics, and econometrics. It aims to develop your skills in mathematical proofs, which are fundamental to economic theory, and to build a solid understanding of key concepts and theories in modern economics.

The course will cover topics including linear algebra, an introduction to real analysis, a detailed study of general optimization, and a brief overview of dynamic optimization. Students should have a basic knowledge of mathematics and an intuitive understanding of fundamental mathematical results and methods.

Intended Learning Outcomes

By the end of this course, students should be able to

1. Demonstrate familiarity with fundamental mathematical results and techniques applicable to postgraduate studies in economics.

2. Apply real analysis concepts to understand the properties of economic functions and their applications in economic theory.

3. Solve constrained and unconstrained optimization problems using both classical and modern approaches.

4. Understand and apply basic concepts in linear algebra relevant to econometric analysis.

Instruction Method

This course will introduce several branches of mathematics relevant to postgraduate studies in economics. I will provide lecture notes with key definitions and mathematical results, explain important models and proofs step by step, and illustrate these results using various numerical examples and graphs.

Textbook

A First Course in Optimization Theory by Rangarajan K. Sundaram
ISBN: 0-521–49770-1, Cambridge University Press

The following books are either good substitutes for our main textbook or contain complementary topics that are useful for your understanding of the course materials. In addition, I will provide detailed lecture notes for all the topics covered in the course.

- "Mathematics for Economists" by Simon and Blume (W.W. Norton)

- "Fundamental Methods of Mathematical Economics" by Alpha Chang (McGraw-Hill)

- "Mathematical Methods and Models for Economists" by Angel de la Fuente (Cambridge)

- "Further Mathematics for Economic Analysis" by Sydsaeter, Hammond, Seierstad, Strom (Prentice Hall)

- "Real Analysis with Economic Applications" by Efe Ok (Princeton)

- "Principles of Mathematical Analysis" by Walter Rudin (McGraw-Hill)

- "Elements of Dynamic Optimization" by Alpha Chang (Waveland)

- "Optimal Control Theory with Applications in Economics" by Thomas Weber (MIT)

- "Recursive Methods in Econ Dynamics" by Lucas, R., N. Stokey, E. Prescott (Harvard)

Prerequisites
Undergraduate level calculus and linear algebra.

Grading: There will be multiple homework assignments and two in-class exams. They will roughly count toward your final grade as follows:

Assignments	20%
Midterm Exam	35%
Final Exam	45%

Attendance Policy
Attendance is **mandatory**, as much of the course content is delivered through lectures. Absences can cause a student to fall significantly behind. I will keep attendance records, and your attendance will affect your final grade. Missing up to two lectures (15%) is regrettable but excusable. However, missing more than two lectures will negatively impact your grade and, in severe cases, will result in **failing the course**.

Assignments:
There will be four homework assignments. Collaboration on homework assignments is allowed, but students should complete and submit the homework assignments on their own. Assignments (and their due dates) will be posted on Canvas. As answer keys to the assignments will be posted immediately after the assignments are turned in, late homework assignments will **not** be accepted.

Exams:
There will be **two** (in-class) written exams, a midterm exam and a final exam. The exams are scheduled as follows:
— **Midterm Exam: Monday, September 23, 9:00am - 11:50am;**
— **Final Exam: Wednesday, October 16, 9:00am - 11:50am.**

Late/Make-Up Policy
Late submissions of homework assignments will **not** be accepted. Schedule conflicts regarding the exams should be reported to the instructor **immediately.** There will be **no** make-up exams unless the circumstances are truly exceptional and can be substantiated (for example, death in the family or very serious medical problems substantiated by a written doctor's note)–Refer to the University's Policy for validity of other excuses. If advanced notice is possible and not given, I will refuse the request.

Course AI Policy
The use of Generative AI is permitted for the course.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST - Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Course Outline

I will **not** organize the course exactly the same as the textbook does and I might add extra materials as we go along. So keep in mind that the following is only a tentative course outline.

- Basic Concepts and Real Analysis (2.5 lectures)

  Mathematical Proofs, Set Theory and Topology, Euclidean Space, Metric Space, Differential Calculus, Convex Analysis.

- Linear Algebra (2.5 lectures)

  Vector, Matrices (Matrix Operations, Rank, Inverse, Determinant), Simultaneous Linear Equations

- Static Optimization (4 lectures)

  Optimization Problems, Existence of Solutions, Unconstrained Optimization, Constrained Optimization, Parametric Continuity

- Dynamic Optimization (3 lectures)

  Dynamic Programming, Finite-Horizon Dynamic Programming, Stationary Discounted Dynamic Programming

TA Contact
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