ECON5102 Mathematics for Economic Analysis

Fall 2021
Department of Economics
The Chinese University of Hong Kong

Professor LI Duozhe
Email: duozheli@cuhk.edu.hk
Lectures: Mon, Wed, Fri 9:30 to 12:15
Aug 2 to Aug 27
Classroom: LT4, Esther Lee Building; Zoom
Office Hour: Fri 14:30 to 15:30

Tutor: Mr. Wai Ho Cheung
Email: waihocheung@cuhk.edu.hk
Tutorials: Thu 9:30 to 10:30
Aug 9 to Sept 3
Classroom: LT4, Esther Lee Building; Zoom
Office Hour: Thu 10:30 to 11:30

Course Description

This course reviews some of the mathematical methods most widely used in modern economic analysis. We shall cover the following topics: linear algebra, elementary real analysis, multivariable differential calculus, theory of optimization with constraints, and if time allows, dynamical systems in discrete and continuous times. It is assumed that the students are familiar with basic calculus and elementary linear algebra.

Learning Outcomes

The primary goal of this course is to provide solid mathematics preparation for graduate study in economics. After taking this course, the students are expected to:

- Master the basic mathematical methods most widely used in economic analysis;
- Become comfortable with reading and analyzing research papers in economics;
- Deepen the understanding of the nature and the role of mathematics in economic analysis.

Recommended Textbooks

The lecture will mainly be based on the following two textbooks:

- **Carl P. Simon and Lawrence Blume**, *Mathematics for Economists*, Norton, 1994.
- **Alpha C. Chiang and Kevin Wainwright**, *Fundamental Methods of Mathematical Economics*, McGraw-Hill, 2005.

Assessment Scheme

The course grade will be determined by class participation (10%), homework (20%), and final exam (70%). The exam schedule is TBA.

Attendance Policy

Students are required to attend all the lectures. Students absent from class for any reason are responsible for the missed work. The tutor will take attendance and those failing to attend three or more lectures will lose the class participation points in the grade.

Homework

There will be five to six homework exercises. Students are required to hand in their homework individually. We will grade two of the homework and use its grade for the homework. The rest of the homework exercises will be collected for record but will not be graded. Suggested solutions will be provided in the tutorials. Homework exercises are meant to help students be familiar with the course materials. Therefore, even though most of the homework exercises will not be graded, students are expected to work on them carefully and attend the tutorial session.

Academic Honesty

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at http://www.cuhk.edu.hk/policy/academichonesty/

Course Content

1. **Linear Algebra**

   Matrix Algebra, Rank, Determinant, Linear Equation Systems, Cramer's Rule, Vector Space, Linear Independence and Dimension, Fundamental Theorem of Linear Algebra

2. **Elementary Real Analysis**

   Metrics and Norms, Sequences, Open and Closed Sets, Continuity, Compact Sets, Extreme Value Theorem, Convex Sets and Separating Hyperplanes, Correspondences, Fixed Point Theorems

3. **Differential Calculus of Several Variables**

   Mean Value Theorem, Taylor Polynomials, Inverse Function Theorem, Implicit Function Theorem, Homogeneous and Homothetic Functions, Concavity and Quasiconcavity

4. **Optimization Theory**

   Optimization with Equality and/or Inequality Constraints, Lagrangian Method, First-Order and Second-Order Conditions, Kuhn-Tucker Conditions, Envelope Theorem and Duality Theory

5. **(If time allows) Dynamical Systems in Discrete and Continuous Times**

   Eigenvalue and Eigenvector, First-Order and Higher-Order Differential Equations, First-Order and Higher-Order Difference Equations, Simultaneous Differential Equations and Difference Equations