



Mathematical Economics (ME)

Basic Information

ERP Class Number: 98251

Units (Credits): 3

Instructor: Ilfan Oh, Ph.D.

Email: ilfanoh@iba.edu.pk

Phone (Office): 3810-4700, Extension: 3021

Address (Office): Room 208, Fauji Foundation Building, IBA Main Campus

Office Hour: 11:00AM-1:00PM & 2:30PM-4:30PM on Wednesday, Spring Semester, 2025 (and by appointment)

Prerequisites

- Intermediate Macroeconomics
- Intermediate Microeconomics
- Linear Algebra and Multivariate Calculus

Time Frame and Location

Session Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
		○		○			
Time		1:00PM - 2:15PM		1:00PM - 2:15PM			
Room		MAC-5		MAC-5			

Grade-Weighting System

The basis of grade-weighting system in this course is as follows:

- Midterm Examination: 40%
- Final Examination: 60%

Note:

N.1: This course does not offer any *extra assignment* in any form.

N.2: In the case of your requesting the **midterm** makeup examination, this course follows the permission rules set by the IBA Examination Office.

N.3: In the case of your requesting the **final** makeup examination, please contact the IBA Examination Office for the details.



Grading Scale

Grade	$X = \text{Score (Unit = Percentage)}$
A	$90 \leq X$
A-	$82 \leq X < 90$
B+	$75 \leq X < 82$
B	$68 \leq X < 75$
B-	$61 \leq X < 68$
C+	$54 \leq X < 61$
C	$47 \leq X < 54$
C-	$40 \leq X < 47$
F	$X < 40$

Academic Policies

Refer to IBA's guidelines specifying academic policies and code of conduct. Particularly, it is strongly recommended that students comply with the guidelines stipulating each of the following items:

- **Academic Honesty and Plagiarism**
- **Attendance and Participation**



Course Description

This course considers some key aspects of the mathematical foundations of the mainstream (orthodox) economic theory. In particular, the course examines mathematical concepts and tools that support the notion of *equilibrium* (a point in a vector space) which is a fundamental building block of the mainstream economic approach ranging from the modern portfolio theory to theories of economic development. In line with our focus on the concept of equilibrium, we restrict our attention to some static models in the framework of the mainstream approach and investigate key mathematical methods which formally characterize the properties of equilibrium in the corresponding economic models. Through the entire course, we will place special emphasis on the applications of mathematical concepts and tools to various economic models rather than purely abstract mathematical theorems.

Learning Goals

The objective of this course is to let students acquire a solid and precise understanding of mathematical methods (in linear algebra and calculus) relevant to economics, and to enhance their ability to interpret economic models through the pertinent use of mathematical reasoning.

Learning Outcomes

Upon completion of the course, students should be able to properly interpret and understand a wide spectrum of advanced modeling approaches in economics and finance, using the mathematical concepts and tools covered in the course.

Teaching and Learning Methodology

In-Class Lectures (subject to change under the IBA academic policy)

Textbook, Suggested Readings, and More

Required Textbooks:

- “*Fundamental Methods of Mathematical Economics*” by Alpha C. Chiang and Kevin Wainwright, McGraw-Hill, Current (4th or Later) Edition, 2004 (Hereafter, “CW”).
- “*Analytical Methods in Economics*” by Akira Takayama, University of Michigan Press, 1993 (Hereafter, “AME”).
- **Note:** Additional learning materials and handouts will be uploaded on LMS.



Supplementary Textbooks: (Not Mandatory):

- “*Mathematical Economics*” by Akira Takayama, Cambridge University Press, 1985: One of the best books in the field.
- “*Mathematical Proofs: A Transition to Advanced Mathematics*” by Gary Chartrand, Albert D. Polimeni, and Ping Zhang, Pearson, Current (4th or Later) Edition, 2018: A very useful book to familiarize yourself with how mathematical proofs work.
- “*An Introduction to Analysis*” by William R. Wade, Pearson, Current (4th) Edition, 2017: Check this book if you would like to study much more rigorous arguments in *Real Analysis* at the undergraduate level.

Suggested Readings 1: Basic Mathematics (Not Mandatory)

- For the students who would like to improve their understanding of mathematics at the elementary level (required in any economics program) with self-studying, I suggest a series of “Schaum’s Outline” published by McGraw-Hill Education Professional. In particular, the following books should be useful to them (the numbering indicates the order of studying). Please check the titles (the latest editions) over the internet.
 1. *Elementary Mathematics* (For review)
 2. *Logic*
 3. *Set Theory*
 4. *Calculus*
 5. *Linear Algebra*
 6. *Advanced Calculus*
 7. *General Topology* (If you’re interested in General Equilibrium Theory)

Suggested Readings 2: Advanced Topics (Not Mandatory)

- “*Real Analysis with Economic Applications*” by Efe A. Ok, Princeton University Press, Current Edition, 2007: A good introductory book at the graduate level.
- “*General Equilibrium Theory: An Introduction*” by Ross M. Starr, Cambridge University Press, Current (2nd or Later) Edition, 2011: One of the best introductory books for the topic.

Computer Language:

- While the use of it is not mandatory in this course, I strongly recommend Julia to everyone who is interested in studying economics and finance at a graduate school in the future. *The sooner, the better.* Among others, I recommend the following resources (Note that each item is a *hyperlink*):
 - Julia Language: [Official Homepage](#)
 - Julia Language: [Official YouTube Channels](#)
 - Economics: [Quantitative Economics with Julia](#)



Topics

Note: The following plan is subject to change due to ups and downs in a pace at which we cover weekly topics.

Week 01: Introduction

Matrix Algebra and Linear Economic Models

Week 02: Matrices, Vectors, and their Operations: Review
(CW: Sections: 4.1-4.6)

Week 03: Nonsingularity Conditions for a Matrix
(CW: Sections: 5.1-5.5)

Week 04: Economic Application I: Macroeconomic Models I
(CW: Sections: 5.6-5.7)

Week 05: Economic Application II: Leontief Input-Output Model I
(CW: Section: 5.7)

Week 06: Economic Application II: Leontief Input-Output Model II
(CW: Section: 5.7; Takayama (1985): Section A in Chapter 4)

Week 07: Review of Topics before Midterm

Week 08: Midterm Examination

Week 09: Mid-Semester Break

Comparative Static Analysis

Week 10: Comparative Static Analysis I: Basic Tools
(CW: Sections: 6.7, 7.2-7.4, 8.2-8.5)

Week 11: Comparative Static Analysis II: Economic Applications
(CW: Section: 8.6; AME: Section 1.5)

Optimization Techniques

Week 12: Concavity and Convexity
(CW: Section: 11.5)

Week 13: Conditions for Extreme Values
(CW: Sections: 9.1-9.4, 11.1-11.4)

Week 14: Optimization with Equality Constraints I: Lagrange-Multiplier Method
(CW: Sections: 12.2-12.3)

Week 15: Optimization with Equality Constraints II: Utility Maximization Program (CW: Section: 12.5)

Week 16: Optimization with Equality Constraints III: Comparative Static Analysis (CW: Section: 12.5)

Week 17: Optimization with Inequality Constraints (CW: Sections: 13.1-13.4; *if time permits*)