



B.E. International Program

Faculty of Economics, Thammasat University



Course Outline

EE 421 Mathematical Economics I Semester 2/2013 (January 13 – May 3, 2014)

Number of credits	3 credits
Lecture Time	Tuesdays and Thursday, 09.30 – 11.00 AM
Lecture Venue	204, 2 nd floor, Faculty of Economics, Thammasat University, Tha Prachan campus
Instructor	Dr. Thanet Makjamroen Office: Room No. 521 Fifth Floor, Faculty of Economics Email : thanet@econ.tu.ac.th Office hours : by appointment

Prerequisite: MA217 (or MA212) and have completed or currently taking EE311

Text: Jeffrey Baldani, et. al., *Mathematical Economics*, 2nd edition, Dryden 2004.

Lecture Notes: Thanet Makjamroen, *Lecture Notes for EE421 Mathematical Economics I*, May 2008.

References:

Gale [1960], *The Theory of Linear Economic Models*, McGraw-Hill.

Jehle [1991], *Advanced Microeconomics Theory*, Prentice-Hall.

Sundaram [1996], *A First Course in Optimization Theory*, Cambridge University Press.

Simon and Blume [1994], *Mathematics for Economics*, Norton.

Sydsaeter and Hammond [1995], *Mathematics for Economic Analysis*, Prentice-Hall.

Evaluation:

Midterm Exam 45% (March 2, 2012)

Final Exam 55% (May 8, 2012)

Topics:**Chapter 1 Introduction**

- 1.1 Mathematical Economic Model
- 1.2 Use of Economic Model
- 1.3 An Example of Mathematical Models

Chapter 2 Calculus of Single Variable

- 2.1 Derivative
- 2.2 Examples of Derivatives in Economics
- 2.3 Derivatives and Increasing Functions
- 2.4 Second- and Higher-Order Derivatives
- 2.5 Optimization: Single Variable
 - 2.5.1 Necessary Conditions
 - 2.5.2 Sufficient Conditions
- 2.6 Concave and Convex Functions
- 2.7 Differentials

Chapter 3 Calculus of Single Variable: Applications

- 3.1 Labor Union
- 3.2 Profit Maximization in Perfect Competition
- 3.3 Profit Maximization of a Monopoly
- 3.4 Taxation on Monopoly
- 3.5 Profit Maximization of Duopoly (Cournot Model)
- 3.6 Balanced-Budget Multiplier

Chapter 4 Multivariate Calculus

- 4.1 Partial Derivatives

- 4.2 Second-Order Partial Derivatives and Cross Partial Derivatives
- 4.3 Total Differentials
- 4.4 Conventions of Matrix Notations for Derivatives of Functions of Several Variables
- 4.5 Chain Rules of Composite Functions of Several Variables
- 4.6 Directional Derivatives
 - 4.6.1 First-order Directional Derivatives
 - 4.6.2 Directional Derivatives and Optimization
 - 4.6.3 Second-order Directional Derivatives
- 4.7 Mean-Value Theorem
- 4.8 Taylor's Polynomials and Taylor's Approximation in \mathbf{R}^n
- 4.9 Implicit Functions and Implicit Function Theorem
- 4.10 LevelSets, Tangents and Gradients
- 4.11 Homogeneity

Chapter 5 Multivariate Calculus: Applications

- 5.1 Balanced-Budget Multipliers in Closed Economy
 - 5.1.1 Simple Keynesian Model
 - 5.1.2 IS-LM Model
 - 5.1.3 Aggregate Demand-Aggregate Supply Model
- 5.2 Monetary Policy Effectiveness
 - 5.2.1 IS-LM Model
 - 5.2.2 Mundell-Fleming Model with Flexible Exchange Rate
- 5.3 Tax Incidence in Supply-Demand Model

Chapter 6 Multivariable Optimization without Constraints

- 6.1 Definitions of Extreme Points
- 6.2 2-Variable Optimization
- 6.3 First-Order Necessary Condition
- 6.4 Second-Order Necessary Condition

- 6.5 Sufficient Conditions
- 6.6 Multivariable Optimization without Constraints
- 6.7 First-Order Necessary Condition
- 6.8 Second-Order Necessary Condition
- 6.9 Sufficient Conditions
- 6.10 Test of Definiteness of the Hessian
- 6.11 Concavity, Convexity and Optimization
- 6.12 Comparative Statics Analysis

Chapter 7 Multivariable Unconstrained Optimization: Applications

- 7.1 Competitive Firm Input Choices: Cobb-Douglas Technology
- 7.2 Competitive Firm Input Choices: General Production Technology
- 7.3 Multiplant Firm
- 7.4 Multi-Market Monopoly
- 7.5 Statistical Estimation: Linear Regression

Chapter 8 Constrained Optimization: Equality

- 8.1 The Lagrangian Method
- 8.2 Graphical Interpretation
- 8.3 Optimization with k Equality Constraints
- 8.4 Second-order Sufficient Conditions
 - 8.4.1 Bordered Hessian for Single Equality Constraint
 - 8.4.2 Bordered Hessian for k Equality Constraints
 - 8.4.3 Test of Bordered Matrix
- 8.5 Comparative Static Analysis: Sensitivity Analysis

Chapter 9 Equality Constrained Optimization: Applications

- 9.1 Cost Minimization and Conditional Input Demand
 - 9.1.1 Sufficient Conditions
 - 9.1.2 comparative Static Analysis
- 9.2 Utility Maximization: Log Utility Function

9.3 Utility Maximization Subject to Budget and Time Constraints

9.3.1 Sufficient Conditions

9.3.2 Sensitivity analysis

9.4 Intertemporal Consumption

9.4.1 2-Period Case

9.4.2 n -Period Case

Chapter 10 Inequality Constraints Optimization

10.1 First-Order Sufficient Conditions: One Inequality Constraint

10.2 First-Order Sufficient Conditions: Several Inequality Constraints

10.3 First-Order Sufficient Conditions: Mixed Constraints

10.4 First-Order Sufficient Conditions: Minimization under Mixed Constraints

10.5 Second-Order Sufficient Conditions: Mixed Constraints

10.6 Second-Order Necessary Conditions

10.7 Comparative Static analysis: Sensitivity Analysis

10.8 Kuhn-Tucker Formulation

Chapter 11 Inequality Constrained Optimization: Applications

11.1 Utility Maximization with Two Goods

11.2 Two Goods Diet Problem: Linear Programming and its Duality

11.3 Sales Maximization

11.4 Intertemporal Consumption with Liquidity Constraint

Chapter 12 Sensitivity Analysis and Envelope Theorems

12.1 The Meaning of the Multipliers

12.2 The Meaning of Lagrange Multiplier: One Equality Constraint Case

12.3 The Meaning of Lagrange Multiplier: Several Equality Constraint Case

12.4 The Meaning of Lagrange Multiplier: Inequality Constraint Case

12.5 Envelope Theorems

12.6 Envelope theorem: Unconstrained Case

12.7 Envelope Theorem: Equality Constraints Case

12.8 Applications: Shephard's Lemma, Roy's Identity and Demand Function

12.9 Envelope Theorem: Inequality Constraints Case

Important dates:

Class begins	January 14, 2014
Adding and dropping courses without record	January 13-27, 2014
Midterm exam	March 6, 2014 ; 09.30 – 11.00 AM
Course withdrawal with "W"	March 19-24, 2014
Class ends	May 1, 2014
Final exam	May 17, 2014 ; 9.00 AM – noon