

Course Outline

EE 421 Mathematical Economics 1

Semester 2/2023 (January 8 – May 4, 2024)

Number of credits: 3 credits (3-0-6)

Lecture Time: Fridays, 9.00 AM – noon

Lecture Venue: Room 204, Faculty of Economics

Teaching Materials Platform: Google Classroom: <https://classroom.google.com>

Class code: rvykylu

Instructor: Asst. Prof. Dr. Sittisak Leelahanon

Email: sittisak@econ.tu.ac.th

Office: Room 416, Faculty of Economics

Office Hours: by appointment

Prerequisites: MA217 (or MA212) and having completed or currently taking EE311

Course Description:

The application of matrices, Jacobian determinants, derivatives, partial derivatives and optimization, with and without constraints, to explain theories in Microeconomics and Macroeconomics, such as the theory of consumer behavior, the theory of production, equilibrium in goods and factor markets, equilibrium of national income in product and money markets, international trade, comparative static equilibrium analysis, the input-output model, determination of maximum-minimum point and duality of linear programming.

Required textbook:

Carl P. Simon and Lawrence Blume, *Mathematics for Economists*, W. W. Norton & Company.

Supplement textbooks:

1. Alpha C. Chiang and Kevin Wainwright, *Fundamental Methods of Mathematical Economics*, 4th ed., McGraw Hill.
2. Knut Sydsæter, Peter Hammond, Arne Strøm and Andrés Carvajal, *Essential Mathematics for Economic Analysis*, 6th ed., Pearson.
3. Knut Sydsæter, Peter Hammond, Atle Seierstad and Arne Strøm, *Further Mathematics for Economic Analysis*, 2nd ed., Pearson.
4. Shayle R. Searle and Lois Schertz Willett, *Matrix Algebra for Applied Economics*, Wiley-Interscience.
5. Rangarajan K. Sundaram, *A First Course in Optimization Theory*, Cambridge University Press.
6. Eugene Silberberg and Wing Suen, *The Structure of Economics: A Mathematical Analysis*, 3rd ed., McGraw Hill.

Evaluation:

Assignments (20%)

Midterm exam (30%) **(Friday, March 1, 2024; 9.00 AM – 11.00 AM)**

Final exam (50%) **(Friday, May 10, 2024; 09.00 AM – noon)**

Topics to cover:**1. Preliminaries**

- (a) Logic and Proof
- (b) Set, Relation and Function
- (c) Number System

2. Univariate Calculus

- (a) Limit, Continuity and Differentiability
- (b) Rolle's Theorem, Intermediate Value Theorem, Mean Value Theorem and Taylor's Theorem

3. Linear Algebra

- (a) Euclidean Spaces, Vector Spaces, Linearly Independent, Spanning, Basis and Direct Sum
- (b) Elementary Operations, Gauss Elimination, Rank and Matrix Analysis
- (c) Eigenvalues, Eigenvectors and Decompositions
- (d) Quadratic Forms and Definite Matrices
- (e) Matrix Differential Calculus

4. Multivariate Calculus

- (a) Contour, Level Set and Linear Transformation
- (b) Limit, Continuity and Differentiability
- (c) Partial Derivatives and Total Differentiation
- (d) Gradient Vector, Jacobian and Hessian Matrix
- (e) Implicit Function Theorems and Their Derivatives

5. Optimization

- (a) Unconstrained Optimization
- (b) Constrained Optimization
- (c) Homogeneous and Homothetic Functions
- (d) Concave and Quasiconcave Functions

6. Applications

- (a) Microeconomic Applications: Consumer Theory, Producer Theory and Market Equilibrium
- (b) Macroeconomic Applications: Classical Macroeconomic Model and Keynesian Model
- (c) Econometric Applications: Least Squares Estimation and Maximum Likelihood Estimation

Expected Learning Outcomes:

1. Morality and Ethics

Applicability	Learning Goals
●	1.1 Students demonstrate integrity.
○	1.2 Students prioritize social and public benefits over personal ones.
●	1.3 Students are punctual and comply with the code of conduct of the institution and society at large.
○	1.4 Students are responsible and accountable to society, the nation, and the subject of economics.
○	1.5 Students realize the cultural and environmental value of the sustainable society.

2. Knowledge

Applicability	Learning Goals
●	2.1 Students know and understand modern economics principles and theories, and are up to date with new developments.
●	2.2 Students know and understand Thai and global economic structure, and the importance of major international economic events.
●	2.3 Students know and understand instruments of economic analysis.
●	2.4 Students know and understand applied fields in economics, including monetary, public, international, business, natural resource and environmental, industrial, agricultural, cooperative, political, developmental, and entrepreneurial economics as well as agribusiness.
○	2.5 Students are informed about related fields including sociology, business administration, education, law policy, and science.

3. Intellectual Development

Applicability	Learning Goals
●	3.1 Students have developed individual critical thinking.
●	3.2 Students are sufficiently trained in research skills.
●	3.3 Students demonstrate an ability to analyze and synthesize data, as well as appropriately integrate economics concepts to understand causes of current economic problems in Thailand. Based on analysis and synthesis, students demonstrate an ability to propose policy guidelines to resolve problems.

4. Interpersonal Skills and Responsibilities

Applicability	Learning Goals
●	4.1 Students are responsible for assigned tasks and work in groups effectively.
●	4.2 Students have problem-solving skills.
○	4.3 Students show leadership skills and team spirit.
●	4.4 Students are always improving themselves.
○	4.5 Students have good interpersonal skills, adapting and working under different conditions.

5. Quantitative Analysis, Communication and Information Technology

Applicability	Learning Goals
●	5.1 Students select and apply appropriate statistical and mathematical methods for data processing, interpretation, conclusions, and recommendations to resolve problems.
○	5.2 Students communicate effectively and select appropriate presentation methods.
●	5.3 Students use information and communication technologies appropriately to gather data as well as process, interpret, and present results.

- ◆ **Mid-Term Examination** (Friday, March 1, 2024; 9.00 AM – 11.00 AM)
- ◆ **Final Examination** (Friday, May 10, 2024; 09.00 AM – noon)