



Course Outline

EE320 Introductory Mathematical Economics (Section 046401)

Semester 2/2025 (January 5 - May 2, 2026)

Lecture Time: Tuesday, 09.00-12.00 hours

Lecture Venue: Room 305

Teaching Materials Platform: Microsoft-Team.

Instructor:

Name: Asst. Prof. Anin Aroonruengsawat, Ph.D.

Office Hours: Tuesday, 13:00 - 15:00 PM, or by appointment

Email: anin@econ.tu.ac.th

Number of Credit: 3 Credits (3-0-6)

Prerequisite: a) EE211, EE212 and MA216 (or MA211) or b) EE213, EE214 and MA 216 (or MA 211)

(Credits will not be awarded to students who are taking or have completed EE421)

Course Description:

Applying mathematical concepts and tools such as functions, equations, matrices, univariate and multivariate differential calculus, constrained and unconstrained optimization, and basic integral to understand the relationship between different economic variables and explain concepts of Microeconomic theory and Macroeconomic theory. An emphasis will be placed on relationships between total, average, and marginal functions, the analyses of elasticity, market equilibrium, impacts of taxation, and the basic input output model.

Course Objectives:

1. To equip students with essential mathematical concepts and tools in studying economics.
2. To expose students to the application of mathematical concepts in analyzing economic problems.

Expected Learning Outcomes

1. Morality and Ethics

Applicability	Expected Learning Outcomes	Evaluation Method
●	1. Students demonstrate integrity.	Assignment plagiarism.
○	2. Students prioritize social and public benefits over personal ones.	
●	3. Students are punctual and comply with the code of conduct of the institution and society at large.	Assignment deadlines and class attendance records.
○	4. Students are responsible and accountable to society, the nation, and the subject of economics.	
○	5. Students realize the cultural and environmental value of a sustainable society.	

2. Knowledge

Applicability	Expected Learning Outcomes	Evaluation Method
●	1. Students know and understand modern economics principles and theories, and are up to date with new developments.	Assignments and Exams.
●	2. Students know and understand Thai and global economic structure and the importance of major international economic events.	Assignments and Exams.
●	3. Students know and understand the instruments of economic analysis.	Assignments and Exams.
●	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.	Assignments and Exams.
○	5. Students are informed about related fields including sociology, business administration, education, law policy, and science.	

3. Intellectual Development

Applicability	Expected Learning Outcomes	Evaluation Method
●	1. Students have developed individual critical thinking.	Examinations.
●	2. Students are sufficiently trained in research skills.	Examinations.
●	3. Students demonstrate an ability to analyze and synthesize data, as well as appropriately integrate economics concepts to understand the causes of current economic problems in Thailand. Based on analysis and synthesis, students demonstrate an ability to propose policy guidelines to resolve problems.	Examinations.

4. Interpersonal Skills and Responsibilities

Applicability	Expected Learning Outcomes	Evaluation Method
●	1. Students are responsible for assigned tasks and work in groups effectively.	Assignments.
●	2. Students have problem-solving skills.	Assignments and Exams.
○	3. Students show leadership skills and team spirit.	
●	4. Students are always improving themselves.	Assignments and Exams.
○	5. Students have good interpersonal skills, adapt, and work under different conditions.	

5. Quantitative Analysis, communication, and information technology

Applicability	Expected Learning Outcomes	Evaluation Method
●	1. Students select and apply appropriate statistical and mathematical methods for data processing, interpretation, conclusions, and recommendations to resolve problems.	Assignments and Exams.
○	2. Students communicate effectively and select appropriate presentation methods.	
●	3. Students use information and communication technologies appropriately to gather data as well as process, interpret, and present results.	Assignments and Exams.

Remark: ● Primary expected outcome ○ Secondary expected

Learning Management and Evaluation

CLO	Learning Management	Evaluation
K1	Acquire and apply knowledge of mathematical functions and	Exams

CLO	Learning Management	Evaluation
	equilibrium analysis to microeconomic and macroeconomic models.	
K2	Apply mathematical tools to analyze policy impacts and solve economic and social problems.	Exams
K4	Reflect on learning progress and adjust strategies to improve understanding of mathematical economics in real-world contexts.	Quizzes/Assignments
S1	Develop systematic thinking and apply mathematical reasoning to economic problem-solving.	Exams /Quizzes/Assignments
S2	Interpret data and use mathematical analysis to propose solutions to economic issues.	Exams
S3	Utilize quantitative techniques such as calculus and matrix algebra in economic modeling.	Exams
E1	Demonstrate ethical awareness when analyzing the societal implications of economic models.	Quizzes/Assignments
E3	Respect differing views in discussions on policy impacts derived from mathematical analysis.	Quizzes/Assignments
C1	Complete written tasks accurately using appropriate mathematical economic tools.	Quizzes/Assignments
C2	Independently and collaboratively analyze economic problems using quantitative methods.	Quizzes/Assignments
C4	Engage in self-directed learning and actively seek improvement in mathematical skills.	Quizzes/Assignments

Learning Assessment Plan

CLO	Methods of Learning Assessment	Assessment Week	Proportion of Assessment
K1, S1	Problem-solving exam on mathematical foundations, static models, and single-variable optimization in economics	Midterm Exam	35%
K2, S2, S3	Applied problem-solving exam on multivariable optimization, constraint analysis, and integral-based policy applications	Final Exam	50%
K4, E1, E3, C1, C2, C4	3 Quizzes	Throughout Semester	15%

Main Text:

Chiang, A. C. and Wainwright, K. (2005) *Fundamental Methods of Mathematical Economics*, 4th edition, McGraw-Hill, Inc., Singapore. **(CW)**

Assesments:

- 1. Quiz** **15%**
 - Total of 3 Quizzes will be given.
 - All quizzes will be informed at least one week in advance.
 - **No makeup quiz will be given.**
- 2. Midterm Exam** **35%**
 - Tuesday, February 24, 2026 12.00-14.00 hrs. (2 hours.)
- 3. Final Exam** **50%**
 - Thursday, May 14, 2026 09.00-12.00 hrs. (3 hours)

Note: Practice problems for each topic will be posted on the class website. Students are encouraged to practice these exercises by themselves regularly.

Grading Criteria:

- Grading will be determined within only this section
- Letter grades are determined based on your relative performance in the class. However, any **score below 40 out of 100 is assigned an F**, and **any score of 85 or above is assigned an A**.

Course Outline and Tentative Class Schedule:

Topics	
1. Introduction <ul style="list-style-type: none"> - Importance and needs to use mathematics in economics. - The nature of theory, economic model, and mathematics. 	CW. Ch. 1
2. Mathematics and Economic Relations <ul style="list-style-type: none"> - Relations and functions - Types of functions 	CW. Ch. 2
3. Static and Comparative Static Equilibrium Analysis <ul style="list-style-type: none"> - Linear models in economics - Simultaneous system of equations - Linear equation and graph - Breakeven analysis - Individual and market demand - Individual and market supply - Partial market equilibrium - Excise tax and market equilibrium - Elasticity concept - Simple macroeconomic model - IS-LM model 	CW. Ch. 3
4. Linear Model, Basic Matrix Algebra and Applications <ul style="list-style-type: none"> - Terminology (Type of matrix) - Matrix operations (add, subtract, multiply) - Representation of system of equation by matrix notation - Matrix inversion by determinants - Determinant and singularity of matrix - Cramer's rule - Matrix applications in: <ul style="list-style-type: none"> - Partial market equilibrium - Excise tax and market equilibrium - Simple macroeconomic model - IS-LM model 	CW. Ch. 4, 5
5. Nonlinear Model and Differential Calculus in Economic Theory <ul style="list-style-type: none"> - Quadratic theory - Other nonlinear functions - Slope and derivatives of a function - Rule of differentiation - Non differentiable functions - Examples in Economics <ul style="list-style-type: none"> - Derivative and marginality - Relations among the total, the average, and the marginal functions - Elasticity, total revenue, and marginal revenue 	CW. Ch. 6, 7, 8
6. Optimization without Constraints: One Independent Variable Case <ul style="list-style-type: none"> - Maxima, minima, and inflection point - Convexity and concavity - Maximize profits <ul style="list-style-type: none"> - Competitive market case - Monopoly case 	

Topics	
<ul style="list-style-type: none"> - Effects of taxes - Lump-sum tax - Profit tax - Excise tax - Maximization of tax revenue 	CW. Ch.9
MIDTERM (Tuesday, February 24, 2026 12.00-14.00 hrs.)	
7. Derivatives of More-Than-One Independent Variable Function <ul style="list-style-type: none"> - First-order partial derivatives - Second-order partial derivatives - Differential - Total differential - Total derivatives - Implicit function and its derivative - Examples in economics <ul style="list-style-type: none"> - Partial market equilibrium - Multipliers in macroeconomic models - Utility function - Production function 	CW. Ch. 7, 8
8. Optimization without Constraint: More-Than-One Independent Variable Cases <ul style="list-style-type: none"> - Conditions for maximum or minimum - Third degree price discrimination - Multi-plant firm - Multi-product firm 	CW. Ch.11
9. Optimization under Equality Constraint <ul style="list-style-type: none"> - Lagrange multiplier - Conditions for optimization - Maximize output level subject to cost constraint - Minimize cost subject to output constraint - Maximize utility subject to fixed budget 	CW. Ch.12
10. Integration and Its Application <ul style="list-style-type: none"> - Terminology in Integration - Rules of Integration - Definite Integration - Applications: <ul style="list-style-type: none"> - Total revenue function from marginal revenue function - Total cost function from marginal cost function - Profit function from MR-MC - Utility function from marginal utility function - Consumption and saving functions from marginal propensity functions - Capital formation and investment functions - Consumer surplus, producer surplus and total surplus - First degree price discrimination 	CW. Ch.14
FINAL (Thursday, May 14, 2026 09.00-12.00 hrs.)	