Course Outline

EE 320 Introductory Mathematical Economics

Semester 2/2022

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

Lecture Time: Tuesday and Thursday, 11:00 – 12.30 hours

Lecture Venue: **Section 046401:** 204
Section 046402: 202

Instructor: **Section 046401: Dr. Anin Aroonruengsawat**
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Section 046402: Dr. Thanet Makjamroen
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Course description:

Study of mathematical concepts and tools such as functions, matrices and higher-order derivatives in cases of single and multiple independent variables. Emphasis is on the application of optimization, both with and without constraints, and introductory integral, for understanding relationships of various economic variables and concepts, such as the relationship of aggregate, average and marginal functions. Other topic covered analyses of elasticities, market equilibrium, impacts of taxation and input-output models.

Prerequisites: a) EE 211, EE 212 and MA 216 (or MA211)
or b) EE 213, EE 214 and MA216 (or MA 211)

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.

Main Text:

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

Other Recommended Books:

Sydsaeter, K. and P. Hammond. (2006). *Essential Mathematics for Economic Analysis*, 2nd edition, Prentice Hall.

Holden, K. and Pearson, A.W. (1992). *Introductory Mathematics for Economics and Business* Second edition, The Macmillan Press Ltd.

Expected Learning Outcomes:

1. Morality and Ethics

Applicability	Learning Goals
●	1.1 Students demonstrate integrity.
O	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.
O	1.4 Students are responsible and accountable to society, the nation, and the subject of economics.
O	1.5 Students realize the cultural and environmental value of the sustenainable 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.
O	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 analsyis 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.

Course Outline:

Lectures	Topics	
(1 lecture)	**1. Introduction** - Importance and needs to use mathematics in economics. - The nature of theory, economic model and mathematics.	CW. Ch. 1
(1 lecture)	**2. Mathematics and Economic Relations** - Relations and functions - Types of functions	CW. Ch.2
(4 lectures)	**3. Static and Comparative Static Equilibrium Analysis** - 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
(3 lectures)	**4. Linear Model, Basic Matrix Algebra and Applications** - 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: - Partial market equilibrium - Excise tax and market equilibrium - Simple macroeconomic model - IS-LM model	CW. Ch. 4, 5
(3 lectures)	**5. Nonlinear Model and Differential Calculus in Economic Theory** - Quadratic theory - Other nonlinear functions - Slope and derivatives of a function - Rule of differentiation - Non differentiable functions - Examples in Economics - Derivative and marginality - Relations among the total, the average and the marginal functions - Elasticity, total revenue and marginal revenue	CW. Ch. 6, 7, 8

(1 lecture)	**6. Optimization without Constraints : One Independent Variable Case**
	- Maxima, minima and inflection point
	- Convexity and concavity
	- Maximize profits
	  - Competitive market case
	  - Monopoly case
	- Effects of taxes
	  - Lump-sum tax
	  - Profit tax
	  - Excise tax
	- Maximization of tax revenue
		CW. Ch. 9

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(5 lectures)	**7. Derivatives of More-Than-One Independent Variable Function**
	- First-order partial derivatives
	- Second-order partial derivatives
	- Differential
	- Total differential
	- Total derivatives
	- Implicit function and its derivative
	- Examples in economics
	  - Partial market equilibrium
	  - Multipliers in macroeconomic models
	  - Utility function
	  - Production function
	  - Etc.
		CW.
		Ch. 7, 8

(4 lectures)	**8. Optimization without Constraint : More-Than-One Independent Variable Cases** - Conditions for maximum or minimum - Third degree price discrimination - Multiplant-firm - Multiproduct-firm	CW. Ch. 11
(4 lectures)	**9. Optimization under Equality Constraint** - Lagrange multiplier - Conditions for optimization - Maximize output level subject to cost constraint - Minimize cost subject to output constraint - Minimize utility subject to fixed budget	CW. Ch. 12

(1 lectures)	**10. Integration and Its Application** - Terminology in Integration - Rules of Integration - Definite Integration - Applications: - 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 - Differential equation (if time allows)	CW. Ch. 14

Note: The class schedule shown above may be adjusted during the semester as needed.

Assessment:

1. Quizzes 10 %
2. Midterm Exam 40 %
3. Final Exam 50 %

Remarks:

- **Mid-Term Examination (Tuesday, February 28, 2023, 12.00 - 14.00 hrs.)**
- **Final Examination (Saturday, May 13, 2023, 09.00 – 12.00 hrs.)**

Academic Calendar (Semester 2/2022):

Activities	Time Period
Classes Begin	January 9, 2023
Add-drop period	January 9 – 22, 2023 *(from 9.00 AM of January 9 to 10.30 PM of January 22)*
Mid-term Examination Period	February 27 - 28 to March 4, 2023
Makha Bucha Day	March 6, 2023
Withdrawal period with "W" on record	January 25 – March 19, 2023 *(from 9.00 AM of March 14 to 10.30 PM of April 25)*
Chakri Memorial Day	April 6, 2023
Songkran Festival Week	April 10 – 16, 2023
Coronation Day	May 4, 2023
Last day of class	May 6, 2023
Final exam period	May 8 – 22, 2023

Public Holiday in red. No classes during this period