



## Course Outline

### EE320 Introductory Mathematical Economics (Section 046402)

Semester 1/2024 (August 13 - December 2, 2024)

**Lecture Time:** Thursday, 09.00-12.00 hours

**Lecture Venue:** Room 304, 3rd Floor, Faculty of Economics

**Teaching Materials Platform:** Google Classroom

**Class Code:** avayb4b

**Link:** <https://classroom.google.com/c/Njg0OTc5NDI2ODMy?cjc=avayb4b>

#### Instructor:

**Name:** Piyawong Punjatewakupt

**Office Hours:** Thursday, 13:00 - 14:00 PM, or by appointment

**Email:** piyawong@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

## Main Text:

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

## Assesments:

1. Quiz 12%
  - Total of 6 Quizzes will be given.
  - The best four will be selected.
  - All quizzes will be informed at least one week in advance.
  - **No makeup quiz will be given.**
2. Assignment 8 %
  - Total of 4 assignments are assigned to work in a group.
  - All count.
  - All group assignments will be informed at least one week in advance.
  - The number of students in group is capped at the maximum of 5 students.

You can change group member for different assignments, but the cap of member number is still effective.

- Only the group leader will be responsible for uploading the answer file to Google classroom.

- To submit your group homework, upload the answer file (in .pdf only) to Google classroom. The required format of your filename is group\_x\_hw\_y when x is your group number, and y is the assignment number. **If you do not follow this instruction, your marking score will be deducted by 50%.**

- The late homework will **not** be accepted.

3. Midterm Exam 35%
  - Scheduled on October, Tuesday 1st 2024 (12.00-14.00: 2 hours.)
4. Final Exam 45%
  - Scheduled on December, Saturday 7th 2024 (09.00-12.00: 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:

- Norm-referenced systems grading with assessments above.
- Grading will be determined within only this section (046402).

## Course Outline and Tentative Class Schedule:

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

| Topics  |                 |
|---|-----------------|
| <ul style="list-style-type: none"> <li>- Effects of taxes</li> <li>- Lump-sum tax</li> <li>- Profit tax</li> <li>- Excise tax</li> <li>- Maximization of tax revenue</li> </ul>   | CW. Ch.9        |
| <b>MIDTERM (Tuesday, October 1, 2024, 12.00-14.00 hrs.)</b>   |                 |
| <b>7. Derivatives of More-Than-One Independent Variable Function</b> <ul style="list-style-type: none"> <li>- First-order partial derivatives</li> <li>- Second-order partial derivatives</li> <li>- Differential</li> <li>- Total differential</li> <li>- Total derivatives</li> <li>- Implicit function and its derivative</li> <li>- Examples in economics <ul style="list-style-type: none"> <li>- Partial market equilibrium</li> <li>- Multipliers in macroeconomic models</li> </ul> </li> <li>- Utility function</li> <li>- Production function</li> </ul>  | CW.<br>Ch. 7, 8 |
| <b>8. Optimization without Constraint: More-Than-One Independent Variable Cases</b> <ul style="list-style-type: none"> <li>- Conditions for maximum or minimum</li> <li>- Third degree price discrimination</li> <li>- Multiplant-firm</li> <li>- Multiproduct-firm</li> </ul>  | CW.<br>Ch.11    |
| <b>9. Optimization under Equality Constraint</b> <ul style="list-style-type: none"> <li>- Lagrange multiplier</li> <li>- Conditions for optimization</li> <li>- Maximize output level subject to cost constraint</li> <li>- Minimize cost subject to output constraint</li> <li>- Maximize utility subject to fixed budget</li> </ul>   | CW.<br>Ch.12    |
| <b>10. Integration and Its Application</b> <ul style="list-style-type: none"> <li>- Terminology in Integration</li> <li>- Rules of Integration</li> <li>- Definite Integration</li> <li>- Applications: <ul style="list-style-type: none"> <li>- Total revenue function from marginal revenue function</li> <li>- Total cost function from marginal cost function</li> <li>- Profit function from MR-MC</li> <li>- Utility function from marginal utility function</li> <li>- Consumption and saving functions from marginal propensity functions</li> <li>- Capital formation and investment functions</li> <li>- Consumer surplus, producer surplus and total surplus</li> <li>- First degree price discrimination</li> </ul> </li> </ul> | CW.<br>Ch.14    |
| <b>FINAL (Saturday, December 7, 2024, 9.00-12.00 hrs.)</b>  |                 |