THE UNIVERSITY OF HONG KONG
FACULTY OF BUSINESS AND ECONOMICS
School of Economics and Finance
ECON0703/ECON2285 – Mathematical Economics

GENERAL INFORMATION
Instructor: Dr. Yulei Luo
Email: yulei.luo@gmail.com
Office: Room 916, K K L Building
Phone: 2859 1042
Consultation time: Mon 15:35 – 17:25
Semester: Fall
Lecture time and venue: Mon 14:30-17:20 KB111

TA: TBA
Pre-requisites: ECON1001/ECON1210 Introductory microeconomics
Co-requisites: NA
Mutually exclusive: NA

Course Website: TBA
Other important details: NA

COURSE DESCRIPTION
Modern economic theory treated mathematically. Topics may include: applications of optimization to choice theory, applications of the implicit function theorem to comparative statics, applications of differential and difference equations to stability of equilibria, applications of linear mathematics and fixed point theorems to Leontief and Arrow-Debreu models, and applications of optimal control theory and dynamic programming to certainty and stochastic dynamic optimization models.

COURSE OBJECTIVES
1. To understand the interconnection of economics and mathematics.
2. To understand optimization (both static and dynamic), the cornerstone of all modern economic theory.
3. To understand economic theory and application.
4. To extend analytic economic research in a methodological way.

FACULTY GOALS
Goal 1: Acquisition and internalization of knowledge of the programme discipline
Goal 2: Application and integration of knowledge
Goal 3: Inculcating professionalism and leadership
Goal 4: Developing global outlook
Goal 5: Mastering communication skills

COURSE LEARNING OUTCOMES

<table>
<thead>
<tr>
<th>Course Learning Outcomes</th>
<th>Aligned Faculty Goals</th>
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<tr>
<td>CLO1 Ability to understand the interconnection of economics and mathematics.</td>
<td>Goal 1</td>
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CLO2 Competence in applying the concept and various theories of optimization.

CLO3 Skills in analyzing problems within the economic framework.

CLO4 Proficiencies in presenting and articulating ideas effectively on economic theories.

Goal 1

Goals 1, 4, 5

Goals 3, 5

COURSE TEACHING AND LEARNING ACTIVITIES

<table>
<thead>
<tr>
<th>Course Teaching and Learning Activities</th>
<th>Expected contact hour</th>
<th>Study Load (% of study)</th>
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<tbody>
<tr>
<td>T&amp;L1. Lectures: Instructor will give lectures on major concepts and issues.</td>
<td>36 hours</td>
<td>30%</td>
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<tr>
<td>T&amp;L2. In-class and tutorial presentation and discussion: Students are expected to present their answers and engage in discussion during lectures and tutorial meetings. Most in-depth learning takes place when students actively engage in discussions and in sharing their ideas.</td>
<td>12 hours</td>
<td>10%</td>
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<tr>
<td>T&amp;L3. Preparation of tutorial presentation</td>
<td>19 hours</td>
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<tr>
<td>T&amp;L4. Consultation: Both instructor and teaching assistant hold weekly consultation hours to answer students’ questions.</td>
<td>3 hours</td>
<td>15.8%</td>
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<tr>
<td>T&amp;L5. Self-study.</td>
<td>50 hours</td>
<td>41.7%</td>
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<tr>
<td>Total</td>
<td>120 hours</td>
<td>100%</td>
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Assessment Methods | Brief Description (Optional) | Weight | Aligned Course Learning Outcomes
A1. Homework       | 3                             | 10%    | CLO 1, 2, 3, 4
A2. Mid-term tests | 2 (open book; open notes)     | 30%    | CLO 1, 2, 3, 4
A3. Final Exam     | 1 (closed book; closed notes) | 60%    | CLO 1, 2, 3, 4

Total 100%

STANDARDS FOR ASSESSMENT

Course Grade Descriptors

A+, A, A-          | Strong evidence of superb ability to fulfill the intended learning outcomes of the course at all levels of learning: describe, apply, evaluate, and synthesis.

B+, B, B-          | Strong evidence of ability to fulfill the intended learning outcomes of the course at all levels of learning: describe, apply, evaluate, and synthesis.

C+, C, C-          | Evidence of adequate ability to fulfill the intended learning outcomes of the course at low levels of learning; such as describe and apply, but not at high levels of
<table>
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<tr>
<th>Grade</th>
<th>Description</th>
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<tr>
<td>D+, D</td>
<td>Evidence of basic familiarity with the subject.</td>
</tr>
<tr>
<td>F</td>
<td>Little evidence of basic familiarity with the subject.</td>
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**Assessment Rubrics for Each Assessment**

**A1. Homework**
graded according to the marks assigned to each question.

**A2 and A3 Midterm and Final Exam**
Midterm and final exam are consisted of calculation and proof problems which are graded according to the marks assigned to each question.

**COURSE CONTENT AND TENTATIVE TEACHING SCHEDULE**

**Chapter 0: Introduction and Development of Mathematical Economics**
A. A philosophical viewpoint from calculus of variations to inter-connect nature, mathematics and economics
B. Historical Development of Mathematical Economics within General Economic Theory

**Chapter I: Math Preliminaries, Optimization, and Monotone Comparative Statics**
A. Math preliminaries
   - Convex Analysis
   - Differentiability, implicit function theorem, envelope theorem
B. Optimization problems with or without constraints
   - Linear and concave programming
   - Profit Maximization by firms, utility maximization subject to budget constraint by consumers
C. Monotone comparative statics
   - Revealed preference argument
   - FOC and implicit function theorem
   - Complementarity: modern perspective

**Chapter II: Market Equilibrium and Welfare Theorems**
A. Fundamental Theorems of Welfare Economics

**Chapter III: Dynamic Programming**
A. Basic results in Lucas and Stokey
   - Optimal growth, wage search

**Chapter IV: Uncertainty or risk and information**
A. Brief review of probability theory
B. Von Neumann-Morgenstern (VNM) Expected Utility Theorem, Arrow-Pratt risk aversion measures (applications to insurance & Finance)
C. Stochastic Order
D. Experiments and their comparison
E. Bayes and Observational Learning

**Chapter V: Game theory**
A. Complete information pure- & mixed-strategy static games; Nash Equilibrium, Existence theorems & Kakutani’s Fixed Point Theorem

**REQUIRED/RECOMMENDED READINGS & ONLINE MATERIALS**
(e.g. journals, textbooks, website addresses etc.)

Lecture notes for the course will be posted on the Moodle.

**Reference textbooks:**
MEANS/PROCESSES FOR STUDENT FEEDBACK ON COURSE

Conducting mid-term survey in additional to SETL around the end of the semester

COURSE POLICY (e.g. plagiarism, academic honesty, attendance, etc.)

Academic Conduct:
The University Regulations on academic dishonesty will be strictly enforced! Please check the University Statement on plagiarism on the web: http://www.hku.hk/plagiarism/. Academic dishonesty is behavior in which a deliberately fraudulent misrepresentation is employed in an attempt to gain undeserved intellectual credit, either for oneself or for another. It includes, but is not necessarily limited to, the following types of cases:

a. Plagiarism - The representation of someone else's ideas as if they are one's own. Where the arguments, data, designs, etc., of someone else being used in a paper, report, oral presentation, or similar academic project, this fact must be made explicitly clear by citing the appropriate references. The references must fully indicate the extent to which any parts of the project are not one’s own work. Paraphrasing of someone else's ideas is still using someone else’s ideas, and must be acknowledged.

b. Unauthorized Collaboration on Out-of-Class Projects - The representation of work as solely one’s own when in fact it is the result of a joint effort. Where a candidate for a degree or other award uses the work of another person or persons without due acknowledgement:
   1. The relevant Board of Examiners may impose a penalty in relation to the seriousness of the offence;
   2. The relevant Board of Examiners may report the candidate to the Senate, where there is prima facie evidence of an intention to deceive where sanctions beyond those in (1) might be invoked.

Cheating on assignments or examinations is another act of academic dishonesty. If you are caught committing cheating, you will receive an “F” grade for the subject. Furthermore, the relevant Board of Examiners may impose a penalty in relation to the seriousness of the offence; or report the candidate to the Senate, where there is prima facie evidence of an intention to deceive.

Class Conduct: Students are required to attend all classes on time. If you miss a class, it is entirely your responsibility for what you have missed. The principle is based on mutual respect in the classroom. Mobile phone and/or alarming device must be switched off or muted. No eating is allowed during class periods. Discussions and questions are encouraged but student should first inform the instructor beforehand, but not chat with others in private.

ADDITIONAL COURSE INFORMATION (e.g. e-learning platforms & materials, penalty for late assignments, etc.)

Students are expected to be familiar with math at the level of University Mathematics 1.

Special Examinations
Student enquiries and applications for special examinations will be forwarded to the School Office to be handled in a formal and consistent manner. The School and the Chief Examiner may approach individual instructors for their recommendation if necessary. Controversial cases may be further discussed in the Internal Examiners’ meeting and the Board of Examiners meeting.

In general, special examinations are not granted to students taking up summer internships. Students are advised to avoid starting their internships before the end of the examination period.

By default, special examinations would be approved:
(1) if incoming/outgoing exchange students have time clash with the next academic semesters in their home/host universities;
(2) due to compassionate reasons; and
(3) on extraordinary medical situation.

Plagiarism and Misconduct
Plagiarism and misconduct cases will be directed to the Chief Examiner and will be permanently recorded in the School for future reference.