

SCHOOL OF ECONOMICS
SINGAPORE MANAGEMENT UNIVERSITY

**ECON 696: Mathematical Methods for
Economic Dynamics**

Academic Year 2024-25, Term 1; Wednesdays, 8:15 - 11:30
at Seminar Room 3.4 of SOE/SCIS2 Building

Instructor: Takashi KUNIMOTO

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Class Web: We use “eLearn-SMU” as this course’s class web.

All the announcements are made via emails on the eLearn system as well as in the class. So, please check this website frequently and make sure that you receive emails through the eLearn system.

OFFICE HOUR: I hold my office hour every Monday from 13:30 to 15:00 (except public holidays, midterm recess and exam period). The schedule of my office hour will be announced later. If you plan to come to my weekly scheduled office hour, you need not make a prior appointment with me by email. Just stop by my office. If I have to cancel my office hour and/or add an extra office hour, I let you know by emails through the eLearn system. **If you want to see me at some other times, I am available only by appointment.**

TA: Feng QIU is our TA for this course. Feng’s email address is feng.qiu.2020@phdecons.smu.edu.sg.

TA’s OFFICE HOUR: Except public holidays, midterm recess and exam period, our TA will be available to answer your questions about the course materials and homework assignments during our TA’s office hour. Feng will have her office hour at *Interactive Learning Space* on the 5th floor of SOE/SCIS2 Building on Thursdays from 15:30 to 17:00.

CLASS TIMINGS

Each class session will be held every week for 3 hours together with 15 minute break in between the two lectures. There will be no presentations or case studies in this course. Each session consists of a lecture by the instructor and a discussion of the assignments and the course materials.

COURSE DESCRIPTION:

Econ 696: *Mathematical Methods for Economic Dynamics* covers mathematical concepts and techniques that are useful for more advanced treatment of economic analysis. We pay special attention to concepts and machineries that allow us to describe dynamic evolutions of economic variables and analyze inter-temporal (i.e., dynamic) optimization of an economic agent. The topics which will be covered are: (1) Topology in the Euclidean Space; (2) Linear Algebra; (3) Multivariate Calculus; (4) Static Optimization; (5) Differential Equations; and (6) Dynamic Optimization in Continuous Time (Calculus of Variations and Control Theory).

LEARNING OBJECTIVES:

This course aims at introducing you to the advanced mathematical techniques, which help you appreciate how mathematics is used to tackle many economic problems. The special emphasis is given to the techniques which allow us to analyze the dynamics of economic variables and the dynamic optimization of a single agent. This course will serve as an excellent addition and preparation for those who take graduate courses (regardless of whether you are at Master or Ph.D level) in Economics.

PREREQUISITE

I assume that all students have taken an undergraduate-level course on Mathematics for Economics. This corresponds to “Mathematics for Economics (ECON 104)” offered at SMU. Besides, it would be helpful if you have already taken the undergraduate-level courses on “Microeconomics,” “Macroeconomics,” and “Econometrics.”

GRADED BASIS: Graded

COURSE UNIT: 1CU

COURSE AREA: Core

RECOMMENDED TEXT AND READINGS:

- **(Main Textbook)** “*Further Mathematics for Economic Analysis*, Second Edition” by Knut Sydsaeter, Peter Hammond, Atle Seierstad, and Atle Strom, Prentice Hall, 2008. In what follows, I abbreviate it to FMEA.
- **(Supplementary Elementary Textbook)** “*Essential Mathematics for Economic Analysis*, Sixth Edition” by Knut Sydsaeter, Peter Hammond, Atle Strom, and Andres Carvajal, Pearson, 2021. This is the textbook for Econ 104: Mathematics for Economics, which is an undergraduate course offered at SMU.

ASSESSMENT METHODS

Faculty have been instructed not to reuse questions verbatim from past year papers or published test banks, for the graded continuous assessments and examinations in this course. Homework Assignments: 15%; Midterm Exam: 30%; and Comprehensive Final Exam: 55%. Note that there will be no makeup for the midterm exam (if missed, with a valid excuse, the final exam will account for 85% of the grade).

- **Homework (15%):** There will be homework assignments throughout the semester. These homework assignments are essential to help you understand the materials of the course. Besides, you should expect that these assignments are very good proxies for how and what questions will be asked in the midterm and final exam.
 - You must be fully aware that copying others' work without solving it on your end will cause a serious consequence in the midterm and final exams.
 - Students are strongly encouraged to work together on homework assignments.
 - At most four students can make a group and hand in their work together, with every member's name and ID number on the front page of the submission. Once again, I repeat the same thing. You must be fully aware that copying others' work without solving it yourself will cause a serious consequence in your performance in the midterm and final exams.
 - The exact way you submit your own work on each homework assignment will be announced later.
 - All assignments are given to you only through our class website.
- **Midterm Exam (30%):** In order to provide each student with the incentive to work on the course materials and homework assignments, there will be the midterm exam right before the midterm recess. The exact format of this exam will be announced later.
- **Final Exam (55%):** We have the comprehensive final exam during the exam period. By "comprehensive" I mean that the exam covers all the topics in the entire course.

ACADEMIC INTEGRITY

All acts of academic dishonesty (including, but not limited to, plagiarism, cheating, fabrication, facilitation of acts of academic dishonesty by others, unauthorized possession of exam questions, or tampering with the academic work of other students) are serious offences.

All work (whether oral or written) submitted for purposes of assessment must be the student's own work. Penalties for violation of the policy range from zero marks for the component assessment to expulsion, depending on the nature of the offense.

When in doubt, students should consult the instructors of the course. Details on the SMU Code of Academic Integrity may be accessed at <http://www.smuscd.org/resources.html>.

ACCESSIBILITY

SMU strives to make learning experiences accessible for all. If students anticipate or experience physical or academic barriers due to disability, please let the instructor know immediately. Students are also welcome to contact the university's disability services team if they have questions or concerns about academic provisions: included@smu.edu.sg.

Please be aware that the accessible tables in the seminar room should remain available for students who require them.

DIGITAL READINESS FOR TEACHING AND LEARNING (DRTL)

As part of emergency preparedness, instructors may conduct lessons online via the Zoom platform during the term, to prepare students for online learning. During an actual emergency, students will be notified to access the Zoom platform for their online lessons. The class schedule will mirror the current face-to-face class timetable unless otherwise stated.

OUTLINE OF TOPICS

Here I specify the outline of topics this course covers and the corresponding chapters of FMEA. Keep in mind that this outline is meant to be a plan and is subject to change during the course.

Week	Dates	Topic	Readings
1	Aug 28	Sets, Functions, and Topology	Appendix A and Chapter 13
2	Sep 4	Linear Algebra	Chapter 1
3	Sep 11	Multivariate Calculus	Chapter 2
4	Sep 18	Static Optimization	Chapter 3
5	Sep 25	Static Optimization	Chapter 3
6	Oct 2	Differential Equations and Midterm Exam	Chapter 5
7	Oct 7 - 13	Midterm Recess	
8	Oct 16	Differential Equations	Chapter 6
9	Oct 23	Calculus of Variations	Chapter 8
10	Oct 30	Control Theory	Chapter 9
11	Nov 6	Control Theory	Chapter 9
12	Nov 11 - 17 (2 hours)	Final Examination	