ECON 4001A

Mathematical Analysis in Economics

Fall 2023

Instructor: Jiankang Zhang
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TA: TBA

Classes:
Mondays 11:35-14:25 (Lecture)
Thursdays 16:05-17:25 (Tutorial)
Log into Carleton Central to view the locations on your timetable.
Office hours: 16:10-17:40 (Mondays or by appointment)

Welcome to ECON 4001: Mathematical Analysis in Economists.

Course Description: The course will be delivered in person. Topics covered include set theory, sequences and series, quadratic forms, separation and fixed-point theorems. Static optimization: including the Weierstrass, Lagrange, and Kuhn-Tucker theorems; convexity and quasi-convexity; and the envelope theorem. Dynamic optimization: including the Maximum Principle and Bellman's equation. Applications of these tools to economic theory are presented.

Learning Outcomes: This course is designed to provide students with a rigorous review of mathematical techniques in economics.

Preclusions and Prerequisites: ECON 3001 with a grade of C+ or higher. Prerequisites will not be waived, and no registration will be permitted without the required prerequisites. Students who believe they have taken a similar background course or courses from another university must provide appropriate documentation to the Department of Economics Undergraduate Advisor, Renee Lortie: renee.lortie@carleton.ca.

Required textbook

Further Mathematics for Economic Analysis (2nd edition)
by Knut Sydsaeter, Peter Hammond, Atle Seierstad, Arne Strom
Prentice Hall, 2008

Course Content

- **Topic I: Mathematical Preliminaries**
  - Chapter 1: Topics in Linear Algebra
  - Chapter 2: Multivariable Calculus
  - Chapter 4: Topics in Integration
  - Chapter 5: Differential Equations I
  - Chapter 6: Differential Equations II
  - Chapter 7: Differential Equations III
  - Chapter 11: Difference Equations
- **Topic II: Static Optimization**

- Chapter 3: Static Optimization

- **Topic III: Discrete Time Optimization**
  - Chapter 12: Discrete Time Optimization

- **Topic IV: Continuous Time Optimization**
  - Chapter 8: Calculus of Variations
  - Chapter 9: Control Theory: Basic Techniques
  - Chapter 10: Control Theory with Many Variables

Grading Scheme

- The final grade will consist of the following elements weighted as shown:
  1. Assignments 20%
  2. One in-class midterm exam 30%
  3. Final exam 50%
- You should hand in the assignments in person during classes on time. Only in exceptional circumstances and with prior arrangements made through the appropriate channels (i.e. documentation from a medical doctor and/or academic counselor) will late assignments be accepted; Otherwise, you will get zero for the assignments.
  - The due date for assignment 1 could be in week 6 or after.
  - The due date for assignment 2 could be in week 8 or after.
  - The due date for assignment 3 could be in week 10 or after.
- The midterm examination will be held after finishing topic II. The date could be in week 6 or after.
- The exact date for the midterm will be announced in advance.
- There will be no deferred mid-term exam. If you miss it due to an emergency or illness and provide **Self-declaration form for Academic Considerations,** the assigned weight will be added to the final exam. Otherwise you will receive zero marks for it.
- The final examination will be three hours in duration at a time and place scheduled by the University.
- All the midterm and the final will be **in person**.
- The final exam will be **cumulative** and cover the **entirety** of the course material.

Satisfactory Performance Criteria: Students must fulfil all of the preceding course requirements in order to achieve a passing grade (D- or higher). Failure to write the final examination when the student has achieved satisfactory performance during the term will result in a grade of 'F' until an appeal to write the deferred final exam in January 2024, if granted by the Registrar's Office. A change of grade will be submitted when the deferred final exam has been written and the marks are available. See Academic Regulation 2.3 for the official meanings of the grades, and note that it stipulates that no course grades are final until approved by the Faculty Dean. Application to write a deferred final examination must be made at the Registrar's Office in writing no later than three working days after the original final examination was scheduled.

Tutorial Groups

Weekly tutorials will be conducted. The TA will show the students the applications of concepts and theories presented in classes step by step by using some examples.

Assignments

1: There are tutorials one hour per week. The TA will present more examples related to the class materials and the assignments; and the students will pick up their marked assignments at that time.
2: Students are encouraged to work through as many textbook problems as possible, since these are the best way to learn the course and prepare for the exams as well. Students may wish to work together on assignments, **BUT** each student **MUST** write up his/her assignments independently.

Brightspace and the Carleton email system will be used extensively as a means of communication with students. Therefore, students are strongly advised to access Brightspace and check their Carleton email at regular intervals in order to check for new information. To access Brightspace and the Carleton email system, students require a MyCarletonOne account. For questions about MyCarletonOne accounts, students should access http://carleton.ca/ccs/get-started/ (and then click on either New Students or New Grad Students, as appropriate) or contact the ITS Service Desk (4th Floor, MacOdrum Library, telephone: 613-520-3700).

Plagiarism: You are responsible for reading and knowing the information about plagiarism, Carleton University resources, and academic accommodations found HERE. Use of ChatGPT and other generative AI is prohibited.

Requests for Academic Accommodation: You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: **carleton.ca/equity/wpcontent/uploads/Student-Guide-to-Academic-Accommodation.pdf**

Religious obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: **carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf**

Academic Accommodations for Students with Disabilities: If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. **carleton.ca/pmc**

If you have any problems and questions, please do not hesitate to ask me for help.