# Topics in Applied Microeconomic Theory

**Class:** MWF 10-10:50 in Seelye 411
**Office Hours:** Tues 3-4pm and Fri 1-2pm in my office (Seelye 305)

The objective of this course is to develop student capacity to understand, construct and analyze mathematical economics models. To do so, the course will review and apply the mathematical techniques from matrix algebra and multivariable calculus commonly used in such analysis. It will also illustrate how those techniques can be used to extend the basic principles of microeconomic analysis to more general and realistic situations than we can illustrate in intermediate microeconomics. Although the outline of the course follows the development of the mathematical material, we will be emphasizing the development of economic models throughout the course. Weekly problem sets will include some practice with the mathematical techniques but will also involve model building exercises.

## Textbook and Requirements

There is one required book for the course: *Mathematics for Economics, 3rd Edition* by Hoy, Livernois, McKenna, Reese, and Stengos. There are a number of other mathematical economics books on reserve in the library. The course pre-requisites are ECO 250, MTH 211, and MTH 212. For students with strong grades in ECO 250 and MTH 211, I will consider waiving the MTH 212 requirement.

## Course Work

Your grade in the course has four components.

- 40% Weekly problem sets
- 15% Take home midterm
- 20% Take home final
- 25% Project

**Reading Assignments** There are reading assignments for most class sessions that will be posted on Moodle. Many of these are chapters from your textbook, but I will also include resources for using Mathematica and some examples of mathematical economic models. The purpose of the reading assignments is to prepare you for our class exercises and the problem sets. I expect you to complete the readings in advance of class and bring your questions. We will spend the first part of every class session working through student questions. It is critical that you bring questions if you have them; if no one brings up questions, I will assume that you are comfortable with the material in the reading and move forward to using it.

**Weekly Problem Sets** As your textbook states, the only way to learn mathematical economics is to *do* mathematical economics. To that end, you will have weekly problem sets that will be completed in Mathematica and turned in electronically. Your problem set will be assigned a completion score from 0-4 based on the percentage of the problem set that you complete and a correctness score from 0-4 based on your specific answers. We will then discuss common pitfalls and questions about why specific answers were incorrect in class the day after the problem set is returned.

**Take-home exams** Both the midterm and the final exam in this class will be take-home exams. They will look similar to the problem sets but will be graded on correctness instead of completion.

**Project** For the course project, you will pose an economic question, develop a mathematical model, and use your model to answer your question. Your model will be developed, analyzed, and presented using Mathematica. You will present an initial version of the model to your classmates and will then revise and submit your final model. You will receive feedback from me on a project proposal, on your presentation to your classmates, and your final project based on the rubric posted on the course webpage.

Deadlines:

- Project Proposal: Fri 3/25
- Presentations: 4/11-15
- Final Project Due: Mon 4/25 before class

## Course Policies

### *Email*

I encourage you to email me at ssayre@smith.edu with questions. I will make every effort to respond to your emails within one business day (i.e. within 24 hours during the week and by the end of the day Monday for emails received over the weekend). I generally will not answer detailed conceptual questions in emails but will ask you to make an appointment to come by my office.

### *Technology in class*

Please make sure that all mobile devices are silenced before class. If you have an emergency, quietly leave the classroom and take your call in the hallway. Laptop use in class tends to detract from class discussion because it places a barrier between participants. Moreover, technology use can be distracting to fellow classmates, in part because the temptation to take "just a second" to check email or web updates is hard to resist. Finally, research demonstrates that students using a laptop to take notes typically retain less information than those taking notes by hand. If you feel that your learning will be hampered by not having access to your laptop for note-taking or other legitimate purposes, please speak to me. Otherwise, keep your laptop turned off and stowed away during class. If you have a tablet that lays flat and wish to use it to take notes with a digital pen, please ensure that no alerts will appear on your device during class.

### *Late Work*

Barring truly exceptional circumstances, late problem sets will not be accepted. I will drop your two lowest problem set scores. Moroever, the take-home exams must be turned in at the specified time. Late submissions of project work will be assessed at penalty of 1/3 step for every 24 hours or portion theoreof beyond the deadline.

### *Academic Honesty*

As in any other course at Smith, you are required to adhere to the provisions of the Honor Code. I take academic honesty very seriously and will report any suspected violations of the Honor Code to the Honor Board.

## Tentative Topics Schedule

The course outline below is tentative and may change based on your interest and the speed with which we move through material. Since this is such a small class, we have considerable flexibility to modify the course schedule based on your preparation and interests. You will have seen most of the mathematical material in each of these topics before; we will be reviewing the math with an emphasis on elements that are particularly important for economics and then focusing on the economic applications.

Week 1 (Jan 25-29): Introductions: Economic models and Mathematica

Week 2 (Feb 1-5): Functions, derivatives, and single-variable optimization

Week 3 (Feb 8-12): Linear algebra

Week 4 (Feb 15-19): Partial derivatives and total differentials

Week 5 (Feb 22-26): Unconstrained multivariate optimization

Week 6 (Feb 29-Mar 4): Constrained multivariate optimization

Week 7 (Mar 7-11): Comparative statics

Week 8 (Mar 21-25): Envelope theorem

Week 9 (Mar 28-Apr 1): Kuhn-Tucker

Week 10 (Apr 4-8): Kuhn-Tucker examples

Week 11 (Apr 11-15): Presentation of models

Weeks 12-13 (Apr 18-29): Dynamics (or additional examples)