

ECON 344-01 – Mathematical Economics

FALL 2015 SYLLABUS

Class Schedule	MW 8.50–10.20am, Hepburn 111
Instructor	Dr. Emir Malikov
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Office Hours	Tue 3–5pm, Wed 4–6pm, whenever my door is open (usually, in afternoons) or by appt

COURSE DESCRIPTION

Mathematics is essential for modern economics. In fact, since the publication of *Foundations of Economic Analysis* by Paul Samuelson in 1947, the language of economics and the methods of modern economic analysis has become, in large part, mathematics:

[...] if I couldn't formulate a problem in economic theory mathematically, I didn't know what I was doing. I came to the position that mathematical analysis is not one of many ways of doing economic theory: It is the only way. Economic theory is mathematical analysis. Everything else is just pictures and talk. (Robert E. Lucas Jr., Nobel laureate in Economics)

This course is designed to give advanced undergraduate students an idea of how the use of college-level mathematics can provide valuable insights into the types of economic problems they have already encountered in their economics courses. The course ensures you are familiar with key mathematical tools and their useful application to economic problems. Hence, the course is valuable for those considering graduate work in economics, applying economic methods in business or finance as well as applying quantitative techniques to other social sciences. We will primarily take mathematical techniques which you have already learned and apply them to economic questions you have already addressed elsewhere. The course therefore puts *less* emphasis on learning new mathematics and/or new economics (although we will do some of both) and *more* emphasis on discovering the important strengths and limitations that mathematics can bring to economic analysis.

COURSE OBJECTIVES

By the end of the course, students are expected to:

- learn how to read and understand most current journal articles in economics without stumbling over the mathematics;
- develop an initial understanding of how to frame economic modeling ideas in mathematical format;
- prepare students to use a wide range of mathematical techniques in advanced economic theory courses;
- develop a set of problem-solving and analytical skills to solve problems in other social sciences.

TEXTBOOK

The required textbook is *Mathematical Economics*, 3rd Ed., by Baldani, Bradfield and Turner (Linus Publications). Should you decide to purchase an older edition of the textbook, please be prepared for discrepancies in the text which I will not be able to help you with.

PREREQUISITE KNOWLEDGE

Prerequisites for this course are ECON 251, 252, MATH 205 and 217. Thus, a solid command of key micro- and macroeconomic concepts as well as multivariate differential calculus, (un)constrained optimization and matrices is expected.

QRC. If you need help throughout the semester or wish to have someone refresh your memory of calculus and/or matrix algebra at the beginning of the semester, the QRC is a good place for that. The center offers mentoring in all quantitative areas.

HOW TO STUDY

You will not learn the material by only sitting in class and listening to me talk. You need to practice! As a good studying strategy, I suggest you to make sure you actively learn while in the classroom as opposed to merely copying the notes down from the blackboard. Further, do not postpone studying relevant material until a quiz/test comes but rather study on a regular basis. I strongly encourage you to see me or folks at the QRC whenever you encounter problems. You are also very much encouraged to form a study group. It helps in understanding the material when you are able to explain your thoughts to your fellow students.

GRADING & ASSIGNMENTS

Your course grade is made up of the following components:

<i>Component</i>	<i>Weight</i>
Class Participation	10%
Quizzes	5%
Problem Sets	20%
Midterm Exams ($\times 2$)	45% (22.5% each)
Final Paper	20%

At the end of the course, your score on each of the above components will be converted to a 100 point based scale. Your final score in the class will be a weighted average of these points. I will then map your final score (also on a 100 point based scale) to the grade you will receive in the course using the following table:

<i>Course Grade</i>	<i>Min Cumulative Score</i>	<i>Course Grade</i>	<i>Min Cumulative Score</i>
4.00	97	2.25	75
3.75	93	2.00	72
3.50	90	1.75	69
3.25	87	1.50	66
3.00	84	1.25	63
2.75	81	1.00	51
2.50	78	0.00	50 and below

IMPORTANT: You may NOT take this course as pass/fail.

NOTE #1: Depending on how hard the homework and exams turn out to be, I may need to reduce the points required for each grade. I will notify you of any such changes.

NOTE #2: Requests to revise grades on exams, homeworks and other assignments are accepted in writing only. Please compose a brief letter argumentatively explaining (point by point) why you think your grade should be changed, then turn in this letter along with the original assignment back to me. You may contest your grade within two weeks from the date your graded assignments was returned to you.

Attendance. While attendance is not required *per se*, it is however highly recommended. In my experience, student performance in the class is highly correlated with attendance. Attendance is also necessary for class participation for which you earn credit. Further, I often teach material that goes beyond the textbook as well as make important announcements in class about assignments which you do not want to miss.

Class Participation. The success of the course depends heavily upon the contributions of each student. It is you who makes the class more fun! I expect you to come to class prepared and willing to contribute to the class discussion, which constitutes a part of your course grade. Hence, make sure to keep with the material as well as to never be shy to ask questions or to share your thoughts. This is an easy way to earn points, so do not miss out. Occasionally, you will also be asked to split into groups and jointly work on problems in class.

Quizzes. To entice you to keep up with the course material, I will occasionally give you a short in-class quiz. The quizzes will mainly cover the material recently learned in class. I will announce the quiz one class in advance (yet another incentive for the class attendance). There will be no make-up quizzes.

Problem Sets. Problem sets will be assigned often throughout the semester. The assignments will include both analytical/quantitative problems, which you will need to solve “by hand”. Homeworks are long and oftentimes challenging, and I therefore advise you to start working on them as soon as they are assigned.

All assignments are due at the beginning of class. Only hard copies will be accepted — please do not email me your assignments. Late submissions will be accepted (for half credit) only if the solution key has not been posted yet. Please do your homework neatly — you even may want to type them up. If more than one sheet of paper is required, make sure to staple them together with your name on each sheet. Unstapled assignments will not be accepted. The grade for each problem set will be based on the percentage of available points that you earn, i.e., converted to a 100 point based scale.

You will be asked to work out the problems in a group with your classmates and to submit one copy of the homework for the entire group. I will pair you up in groups myself, each time with different people. This is meant to ensure that there is no free-riding as well as to create an opportunity for you to get to know the rest of the class.

Exams. Exams will primarily focus on the material most recently covered in class. Exams are always and everywhere your work. If I find that you have copied off a classmate, I will forward the case to the academic honor council with the recommendation that you fail the course if found guilty.

The dates of midterm exams are to be determined depending on the flow of the class. The first midterm will take place some time in late October; the second midterm will take place during the week of November 30–December 4. I will announce the exact dates of both midterms at least two weeks in advance. There is no final in this class.

Final Paper (Group Project). You and your two partners will conduct a group project, whereby you will be asked to pick a journal article from the list below and write a short paper on it. Your paper should include the following:

- (i) a summary of the main contribution of the article;
- (ii) a brief review of the main results;
- (iii) a thorough analysis of the mathematical model developed in the article, including the detailed derivation of the core model accompanied with in-depth intuitive (economic) interpretations;
- (iv) suggestions on some extension of the article, including an economic motivation for such an extension (i.e., the explanation why it is important/interesting) and a detailed outline of how you would potentially model this extension mathematically.

The paper must be at least 5 (1.15pt-spaced) pages long. The project is meant to demonstrate your ability to understand and use mathematical techniques in a practical context. Detailed instructions will be discussed in class. Below is the list of journal articles to choose from:

- Averch, H. and L. Johnson, “Behavior of the Firm under Regulatory Constraint”, *American Economic Review*, 1962, 52(5): 1053–1069.
- Akerlof, G., “The Market for “Lemons”: Qualitative Uncertainty and the Market Mechanism”, *Quarterly Journal of Economics*, 1970, 84(3): 488–500.
- Barro, R., “Are Government Bonds Net Wealth?”, *Journal of Political Economy*, 1974, 82(6): 1095–1117.
- Becker, G., “A Theory of the Allocation of Time”, *Economic Journal*, 1965, 75(299): 493–517.
- Blinder, A.S. and R.M. Solow, “Does Fiscal Policy Matter?”, *Journal of Public Economics*, 1973, 2(4): 319–337.
- Dorfman, R. and P. Steiner, “Optimal Advertising and Optimal Quality”, *American Economic Review*, 1954, 44(5): 826–836.
- Dornbusch, R., “Expectations and Exchange-Rate Dynamics”, *Journal of Political Economy*, 1976, 84(6): 1161–1176.
- Ferguson, C.E. and T.R. Saving, “Long-Run Scale Adjustments of a Perfectly Competitive Firm and Industry”, *American Economic Review*, 1969, 59(5): 774–783.
- Gronau, R., “Leisure, Home Production and Work – The Theory of the Allocation of Time Revisited”, *Journal of Political Economy*, 1977, 85(6): 1099–1123.
- Kydland, F. and E. Prescott, “Rules Rather than Discretion: The Inconsistency of Optimal Plans”, *Journal of Political Economy*, 1977, 85(3): 473–491.
- Lancaster, K., “A New Approach to Consumer Theory”, *Journal of Political Economy*, 1966, 74(2): 132–157.
- Lipsey, R.G., and K. Lancaster, “The General Theory of Second Best”, *Review of Economic Studies*, 1956–1957, 24(1): 11–32.
- McDonald, I. and R. Solow, “Wage Bargaining and Employment”, *American Economic Review*, 1981, 71(5): 896–908.
- Oi, W., “A Disneyland Dilemma: Two-Part Tariffs of a Mickey Mouse Monopoly”, *Quarterly Journal of Economics*, 1971, 85(1): 77–96.
- Poole, W., “Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model”, *Quarterly Journal of Economics*, 1970, 84(2): 197–216.
- Rosen, S., “The Economics of Superstars”, *American Economic Review*, 1981, 71(5): 845–858.
- Salant, S.W., S. Switzer, and R.J. Reynolds, “Losses from Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium”, *Quarterly Journal of Economics*, 1983, 98(2): 185–213.
- Samuelson, P.A., “An Exact Consumption-Loan Model of Interest with or Without the Social Contrivance of Money”, *Journal of Political Economy*, 1958, 66(6): 467–482.

- Sargent, T.J. and N. Wallace, “Rational Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule”, *Journal of Political Economy*, 1975, 83(2): 241–254.
- Schmalensee, R., “Entry Deterrence in the Ready-To-at Breakfast Cereal Industry”, *Bell Journal of Economics*, 1978, 9(2): 305–327.
- Varian, H., “A Model of Sales”, *American Economic Review*, 1980, 70(4): 651–659.
- Willis, R.K., “A Theory of Out-of-Wedlock Childbearing”, *Journal of Political Economy*, 1999, 107(S6): S33–S64.

When submitting the final paper, you can earn bonus points if it is typed up using a scientific word processor such as L^AT_EX.

MAKE-UPS

- No make-up quizzes, homework assignments or exams.
- The lowest quiz score will be dropped.
- If you must miss an exam/quiz because of a SLU sanctioned event, please make an arrangement with me in advance. If you fail to do so ahead of time, you will receive a zero for that exam/quiz. The format of a make-up exam/quiz is at my discretion.

ANNOUNCEMENTS

All announcements (including homework assignments) as well as supplementary material will be posted on *Sakai*. It is your responsibility to check for announcements at least once a day.

OFFICE HOURS

My posted office hours are Tue 3–5pm and Wed 4–6pm. If you cannot make it during these hours, please email me for an appointment and we will make it work. You are also welcome to come by my office (for help, advice or just to talk) whenever my door is open. However, it is preferable to both you and I that you make an appointment with me so that I reserve enough time for us to go over whatever questions you may have. Please also note that I’m mostly unavailable on Fridays.

EMAILS

If you cannot make it to see me in my office, feel free to email me with any questions — I will be happy to help. However, please keep in mind that it is nearly impossible to meaningfully answer *conceptual* questions via email. In such instances, I will customarily ask you to see me in person in order to get your question answered/explained.

I do not discuss students’ grades over email, period. While it is pleasing to see that you are concerned about your performance in class, please do not email me about the latter, but rather stop by my office to talk about it in person.

Lastly, while I am fairly quick in responding to students’ emails, emails (except those on urgent matters) sent to me over the weekend and/or after 5 pm on week days generally will not be replied to sooner than the morning of the following working week day.

CLASSROOM ETIQUETTE

Please be considerate to myself and those around you:

- Turn off your cell phones before the lecture starts. This also implies no texting/facebooking/instagraming/snapchatting or playing with your iPads during the lecture, not even under the desk. If I see you using a phone, tablet, etc., during class and it does not appear to be for a legitimate class purpose, I will call on you.
- The use of laptops is permitted for course-related purposes only. If you do use a laptop, please sit in the front row.
- Please wait until the lecture ends before gathering your belongings.
- If you need to leave early, please sit near the door. If you arrive late to class, please minimize the distraction to the lecture.
- Please do not eat in class, unless you have valid medical reasons for that.

COURSE OUTLINE

This course outline is tentative and subject to change as the semester progresses.

(1) Introduction

Review of Basic Calculus ([Appendix 1.1 of Ch. 1](#))

- First- and Second-Order Differentiation
- Partial Derivatives
- Concavity and Convexity
- “Marginal” means “Derivative”
- Elasticities

Intro to Economic Modeling ([Ch. 1–2](#))

- Economic Models
- Optimization
- Value Functions and the Envelope Theorem

(2) Matrix Algebra ([Ch. 3–4](#))

- Scalars, Vectors and Matrices
- Matrix Manipulation
- The Inverse of a Matrix and Determinants
- Solving Systems of Equations via Matrix Inversion and Cramer’s Rule

(3) Multivariate Calculus ([Ch. 5–6](#))

- Partial and Total Differentiation
- Differentials
- Implicit Function and Implicit Differentiation
- Homogeneity

(4) (Static) Optimization

Unconstrained Optimization ([Ch. 7–8](#))

- Univariate Optimization
- Multivariate Optimization and Hessian Matrices
- Concavity and Convexity in Optimization Problems
- Comparative Statistics

Equality Constrained Optimization (Ch. 9–10)

- The Lagrangian Method
- Comparative Statistics
- Value Functions and the Lagrangian Multiplier
- *Economic Applications*

Inequality Constrained Optimization (Ch. 11–12)

- Univariate Optimization with an Inequality Constraint
- The Kuhn-Tucker Conditions

(5) **Select Economic Applications from Advanced Economic Theory** (Class Notes)

Possible economic applications to be considered include:

- The Solow Growth Model
- Capital Asset Pricing Model
- Consumer Decisions under Uncertainty
- Imperfect Capital Markets: Investment Decisions under Asymmetric Information

ACADEMIC HONOR POLICY

The academic honor policy outlined in the Constitution of the Academic Honor Council will be enforced in this class. An online copy of the constitution can be found [here](#).

STUDENTS WITH DISABILITIES

If you have a disability and may need accommodations please be sure to contact the Disability and Accessibility Services Office right away so they can help you get the accommodations you require. If you need to use any accommodations in this class, please submit to me a letter from Disability and Accessibility Services in a timely manner so that you can have the best possible experience this semester. Please inform me of any accommodations that you need at least 10 days before the exam and/or assignment deadline.

RELIGIOUS OBSERVANCES

If you have a conflict with a scheduled exam, assignment or some other course requirement due to religious obligations, please inform me of this at least 10 days before the exam and/or deadline.