# ECON5153 MATHEMATICAL ECONOMICS

University of Oklahoma, Fall 2014

Tuesday and Thursday, 9-10:15am, Cate Center CCD1 338


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| Instructor: | Qihong Liu |
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| Office Hours: | Tuesday and Thursday, 1:30-2:30pm, and by appointment |


## Course Description

This is the first course in the graduate Mathematical Economics/Econometrics sequence. The objective of this course is to acquaint the students with the fundamental mathematical techniques used in modern economics, including *Matrix Algebra*, *Optimization* and *Dynamics*. Upon completion of the course students will be able to set up and analytically solve constrained and unconstrained optimization problems. The students will also be able to solve linear difference equations and differential equations.

## Textbooks

Required: Simon and Blume: *Mathematics for Economists*, W.W.Norton, 1994.

Other useful books available on reserve at Bizzell:

Chiang and Wainwright: *Fundamental Methods of Mathematical Economics*, McGraw-Hill, Fourth Edition, 2005.

Darrell A. Turkington: *Mathematical Tools for Economics*, Blackwell Publishing, 2007.

Avinash Dixit: *Optimization in Economic Theory*, Oxford University Press, Second Edition, 1990.

Michael D. Intriligator: *Mathematical Optimization and Economic Theory*, Prentice-Hall, 1971.

## Assessment

Grades are based on homework (15%), class participation (10%), two midterm exams (20% each) and final exam (35%). You are encouraged to form study groups to discuss homework and lecture materials. All exams will be in closed-book forms.

## Problem Sets

Several problem sets will be assigned during the semester. You will have at least one week to complete each assignment. Late homework will not be accepted. You are allowed to work

with other students in this class on the problem sets, but each student must write his or her own answers. Each student is also required to write the names of the other students he or she worked with on each homework assignment.

**Exam Dates**

Midterm 1 – Tuesday, September 30

Midterm 2 – Thursday, November 6

Final – Thursday, December 11, 8-10am

**Tentative Outline**

SB=Simon and Blume. Approximate number of lectures to cover each chapter is listed in parenthesis.

1. Introduction (0.5)

2. One-variable calculus is mainly for self-reading. SB Part I, Appendix A1, A2.1-A2.3, A2.7 (1.5)

3. Matrix algebra (6)

(i) System of linear equations, matrix operations and rank. SB 7.1-7.4, 8.1-8.4. Turkington 2.

(ii) Determinant and applications. SB 9.1-9.2, 26.1-26.3.

(iii) Euclidean spaces and linear independence. SB 10.1-10.4, 11.1.

Chapter 4: Functions of several variables (3)

(i) Limits and sets. SB 12.

(ii) Functions of several variables. SB 13.2-13.5, 30.1.

(iii) Calculus of several variables. SB 14.2, 14.4, 14.6, 14.8.

(iv) Implicit function theorem. SB 15.3

*Exam 1 approximately here.*

Chapter 5: Optimization (11)

(i) Quadratic forms and definite matrices. SB 16, especially pp. 391-392.

(ii) Unconstrained optimization. SB 17, 30.2-30.4

(iii) Constrained optimization I: FOCs. SB 18, Dixit. 1-6.

(iv) Constrained optimization II. SB 19.1-19.3, 30.5.

(v) Homogeneous and homothetic functions. SB 20.1, 20.3-20.4.

(vi) Concave/convex and quasiconcave/quasiconvex functions. SB 21.1-21.3.

*Exam 2 approximately here.*

Chapter 6: Dynamics (7)

(i) Linear difference equations, eigenvalues and eigenvectors. SB 23.1-23.4, 23.7-23.8.

(ii) Ordinary differential equations. SB 24.1-24.3.

Handouts: Integration; Probability and Statistics (1)

Follows *Must-have Math Tools for Graduate Study in Economics* by William Neilson, Chapters 10-13. The book is downloadable at

`http://web.utk.edu/~wneilson/mathbook.pdf`

*Final exam.*