Course Syllabus
MATHEMATICS
FOR ECONOMICS PHD

Instructor: Mariam Arzumanyan

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Office Hours: To Be Announced (TBA)
Credits: TBA
Semester: Fall 2021
Meeting Times: August 16-20, 8:00 am-12:00 pm
Location: TBA

Course Description

This course covers a selection of topics from mathematical analysis, linear algebra, multivariable calculus, integration, optimization theory, differential, and difference equations. The course aims at closing the mathematical literacy gap between students and preparing them for taking regular first-year PhD courses. We will try to strike a balance between rigor and accessibility.

Textbook/Other Required Materials

1. **Simon, and Blume, (1994). Mathematics for Economists. W. W. Norton.**
2. Mas-Colell, Whinston, Green, (1995). Microeconomic Theory: Mathematical Appendix. Oxford University Press.
3. Sydsæter, Hammond, Seierstad, and Strom, (2008). Further mathematics for economic analysis. Pearson education. Financial Times/Prentice Hall, second edition.
4. De la Fuente, A. (2000). Mathematical Methods and Models for Economists. Cambridge University Press.
5. Stokey, Lucas, Prescott, (1989). Recursive Methods in Economics Dynamic, Harvard University Press.

Assignments: There will be 5 assignments that are a combination of reading comprehension, problem solving and concept analysis. Assignments are not graded.

Students with Disabilities

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to disability@illinois.edu DRES Website: www.disability.illinois.edu/

Course Outline

	Logic and Proofs Methods
(a)	Statements
(b)	Logical Connectives
(c)	Quantifiers
(d)	Proof Methods
(e)	Some Proofs in Set Theory
(f)	Some Proofs in Probability Theory
	Matrix Algebra
(a)	Addition, Subtraction, Scalar Multiplication
(b)	Matrix Multiplication, Kronecker Product
(c)	Transpose
(d)	Rank
(e)	System of Equations in Matrix Form
(f)	Determinants
(g)	Eigenvalues, Eigenvectors
	Topics in Mathematical Analysis
(a)	Points, Vectors, Lines, Planes
(b)	Limits
(c)	Open Sets
(d)	Closed Sets
(e)	Convex Sets and Separating Hyperplanes
(f)	Sequences
(g)	Basis and Dimensions
	Functions and Correspondences
(a)	Continuous Functions
(b)	Derivatives, Gradients
(c)	The Chain Rule
(d)	The Product Rule
(d)	The Implicit Function Theorem
(e)	Homogeneous Functions
(f)	Concave and Quasiconcave Functions
(g)	Upper and Lower Hemicontinuity
(h)	Fixed Point Theorems
(i)	Integrals

	Unconstrained Optimization
(a)	Definitions
(b)	First Order Conditions
(c)	Second Order Conditions
(d)	Global Maxima and Minima
	Constrained Optimization
(a)	Definitions
(b)	Lagrangian Function
(c)	Kuhn-Tucker Conditions
(d)	Second Order Conditions
(e)	The Envelope Theorem
(f)	Minimization Problems
(g)	Comparative Statics
	Differential and Difference Equations
(a)	First order differential and difference equations,
(b)	System of difference equations,
(c)	Existence and uniqueness of solution: Picard's and Cauchy-Peano theorems
	Dynamic Programing
(a)	Definitions
(b)	The Recursive Approach
(c)	Bellman Optimality Principle
(d)	Euler Equations
(e)	Markov Processes
	Introduction to Python Numpy and Pandas Libraries