Athens University of Economics and Business
School Of Economics
Master's Program
M.Sc. in Economics

MATHEMATICS

Winter Semester 2026-2027
Tuesday 12:00-15:00 pm / Room 403 Lefkados Building, 4th Floor

Instructor: Vanghelis Vassilatos
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Course Outline

This course is an introduction to commonly used dynamic optimization methods in economics. The emphasis is on solution methods rather than rigorous proofs. After completing the course, students will be able to compile the knowledge they have gained and, apply the techniques mastered in order to analyze, evaluate and solve dynamic models.

Evaluation

The course grade will be determined by the final exam.

A 10% bonus will be awarded to all students that will fulfill all assignments that will be distributed during the course. The bonus is not valid for the September resit examination period.

Syllabus

A. Dynamic Optimization in Discrete and Continuous Time Dynamic Systems

   A1. Optimal control
   A2. Dynamic programming

B. Discrete Dynamics

   B1. First, second and higher order linear difference equations
   B2. Linear difference equation systems

C. Solution methods of linear rational expectations systems

D. Continuous Dynamics

D1. First, second and higher order linear differential equations
D2. Linear differential equation systems
D3. Phase Diagrams

Reading List

Abadir, Karim and Magnus, Jan, Matrix Algebra, Cambridge Universiy Press, 2005.

Adda, Jerome and Cooper, Russell, Dynamic Economics, MIT Press, 2003.

Blanchard, Olivier and Fischer, Stanley, Lectures on Macroeconomics, MIT Press, 1989.

Caputo, Michael R., Foundations of Dynamic Economic Analysis, Optimal Control Theory and Applications, Cambridge University Press, 2005.

Chiang, Alpha, Elements of dynamic optimization, McGraw-Hill, 1992.

De la Fuente, Angel, Mathematical methods and models for economists, Cambridge Universiy Press, 2000.

Farmer, Roger, The Macroeconomics of Self-Fulfilling Prophecies, MIT Press, 1993.

Gandolfo, Giancarlo, Economic Dynamics, Springer 1997.

Hadley, G., Linear Algebra, Addison-Wesley, 1961.

Hoy, Livernois, McKenna, Rees, Stengos, Mathematics for Economics, 2nd edition, MIT Press, 2001.

Kamien, Morton and Schwartz, Nancy, Dynamic Optimization, North Holland 1991.

Ljungqvist, Lars, Sargent, Thomas J., Recursive Macroeconomic Theory, 4th edition, MIT Press, 2018.

Sargent, Thomas J., Macroeconomic Theory, Academic Press, 1st Edition, 1979.

Sargent, Thomas J., Dynamic Macroeconomic Theory, Harvard University Press, 1987

Shone, Ronald, Economic Dynamics, Cambridge Universiy Press, 1997.

Simon, C.P. and Blume, L., Mathematics for Economists W.W.Norton, 1994.

Sorger, Gerhard, Dynamic Economic Analysis, Deterministic Models in Discrete Time, Cambridge Universiy Press, 2015.

Stachurski, John, Economic Dynamics, Theory and Computation, MIT Press, 2009.

Stokey, N.L., Lucas, R.E., Recursive Methods in Economic Dynamics, Harvard University Press, 1989.

Sydsaeter, Hammond, Seierstad, Strom, Further Mathematics for Economic Analysis, Prentice Hall, 2005

Turkington, D.A., Mathematical Tools for Economics, Blackwell, 2007.

Turnovsky Stephen, Methods of Macroeconomic Dynamics, 2nd edition, MIT Press, 2000.

More advanced reading

Carter, Michael Foundations of Mathematical Economics, MIT Press, 2001.

Corbae, D., Stinchcombe, M. B., Zeman, J., An Introduction to Mathematical Analysis for Economic Theory and Econometrics, Princeton University Press, 2009.

De la Fuente, Angel Mathematical Methods and Models for Economists, Cambridge University Press, 2000.

Ok, Efe A., Real Analysis with Economic Applications.

Rangarajan K. Sundaram, A First Course in Optimization Theory, Cambridge University Press, 1996.

Studying Suggestions

For Optimal Control check first Hoy, et al, Chiang and Sydsaeter, et al

For Dynamic Programming check first Sargent (1987), Chapter 1, Stokey & Lucas, Chapters 2-4 and Ljungqvist & Sargent.

For difference and differential equations check Gandolfo, as well as Chiang, Hoy, et al and Sydsaeter, et al. For operators, Sargent (1979).

Note that the mathematical appendices of macro, micro and econometrics textbooks can be very useful!