# Mathematics for economics and financial applications

## Prof. Monica Bianchi

## ***COURSE AIMS and intended learning outcomes***

The course provides mathematical tools for the investigations of economic and financial models where either static optimization or the solution of differential /difference equations are involved. The course would also encourage the students to identify in their personal career different contests where the mathematical instruments presented can be profitably applied.

At the end of the course students should:

1. have acquired the knowledge and understanding of the main parts of the program and be able to apply the mathematical methods described in the program in order to solve problems and exercises;

2. be able to apply the mathematical tools learned in the course to model and analyse economic problems;

3. be able to face mathematical models of complex economic systems analysing critically the results;

4. have learned a rigorous and essential language that allows them to communicate clearly and effectively the knowledge;

5. have developed good learning skills that allow them to continue their plan of studies.

***COURSE CONTENT***

*Preparatory concepts:*Real vector spaces. Eigenvalues and eigenvectors. Diagonalization. Quadratic forms.

*Optimization:*Unconstrained optimization in Rn. Convex and concave functions. Constrained static optimization: the Lagrange and Kuhn-Tucker conditions. Convex programming and sensitivity analysis.

*Dynamical systems:* First order differential equations: separable variable, linear, Bernoulli and Riccati. Linear differential and difference equations with constant coefficients. First order linear systems of differential and difference equations. Equilibrium points for autonomous differential and difference equations and stability criteria. Phase diagrams. Equilibrium points for first order autonomous systems of differential and difference equations and stability criteria.

***READING LIST***

Suggested reference:

M. Bianchi – G. Messineo , *Appunti di Matematica per l’Analisi Economica – Volume I e II, Giappichelli, 2022.*

Further references:

E. Salinelli-F. Tomarelli, *Modelli dinamici discreti,* Springer, 2009 (seconda edizione).

S. Salsa-A. Squellati, *Modelli dinamici e controllo ottimo,* Egea, 2006.

C.P. Simon-L.E. Blume, *Matematica per le scienze economiche e sociali,* Vol. 2, Università Bocconi Editore, 2002.

K. Sydsaeter-P. Hammond-A. Seierstad-A. Strom, *Further Mathematics for Economic Analysis,* Prentice Hall, 2005.

***TEACHING METHOD***

Lectures, assignments.

***ASSESSMENT METHOD AND CRITERIA***

Grading is based on a written test. For all student it is possible to take two partial tests which equally contribute to the final evaluation: the first test is planned during the class period and the second one during the winter exam session.

***NOTES AND PREREQUISITES***

Students are required to have basic knowledge of integral calculus for one variable functions, linear systems, differential calculus rules in R2.

***OFFICE HOURS***

By appointment in presence (Room 220 Via Necchi 9, second floor) or on line by contacting the teachers via e-mail [monica.bianchi@unicatt.it](mailto:monica.bianchi@unicatt.it)