

## MATHEMATICS FOR ECONOMIC ANALYSIS

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### Outline of course content – Academic Year 2016/2017

- **Number of credits**

10 credits (CFU) , 70 hours.

- **Purpose of the course**

The course is designed to establish elementary skills in Mathematical Methods and to initiate the development of an ability to apply these mathematical methods to problems in the fields of economics and finance.

- **Prerequisites**

Topics from an undergraduate level course in mathematics.

- **Outline of course content**

**Vector spaces.** The space  $\mathbb{R}^n$  and the geometric representation of  $\mathbb{R}^2$  and  $\mathbb{R}^3$ . The set of matrices  $2 \times 3$ . Definition of vector space and vector subspace. Examples and basic properties. Linear dependence and linear independence. Spanning set. Basis and dimension. Standard bases. Vector spaces of matrices; null space, row space and column space. Vector spaces of polynomials.

**Euclidean vector spaces.** Inner product; norm of a vector; orthogonal vectors; orthonormal bases.

**Complex numbers.**

**Eigenvalues and eigenvectors.** Definition of eigenvalue, eigenvector, eigenspace. Basic properties. Computation of eigenvalues and eigenvectors; examples. Symmetric matrices and their properties. Similar matrices. Diagonalization. Powers of diagonalizable matrices. An application to networks: the eigenvalue centrality and Google Page Rank.

**Quadratic forms.** Definitions and classification. Identification criteria.

**Convex and Concave functions.** Definitions and properties. Characterizations. Examples and applications. Quasi-convex and quasi-concave functions: definitions and properties.

**Integral calculus.** Definitions, area and integrals, examples and applications, the fundamental theorem of calculus, integration techniques.

**Linear differential equations with constant coefficients of order n and homogeneous systems of linear differential equations with constant coefficients.** Definitions. Initial value problems. The existence and uniqueness of solutions. General solutions and particular solutions. The general solution for a non-homogeneous equation. The general solution for an homogeneous equation: the characteristic equation. Particular solutions for some non-homogeneous cases.

**Linear differential equations with variable coefficients and some examples of non-linear differential equations.** The variation of parameters method.

- **Textbooks**

Some topics can be found in:

C.P. Simon and L. Blume, “*Mathematics for economists*”, Norton 1994.

Since it is difficult to find a textbook where all topics are faced with a proper level of mathematical difficulty, lecture notes or extra references on specific topics will be provided under request .

- **Teaching strategies**

The mode of teaching will be via face to face lectures and exercises. Additional exercises with solutions can be downloaded on the lecturers’ websites.