



UNIVERSITÀ
CATTOLICA
del Sacro Cuore

Mathematics for economics analysis

PROF. GERD WEINRICH

Course aims and intended learning outcomes

The aim of the course is to provide students with the knowledge of the relevant mathematical tools and the ability to apply them to deal with and solve mathematically formalized economic problems.

At the end of the Course student should:

1. have acquired the understanding and the knowledge of the content of the program;
2. be able to apply the tools and concepts learned to specific mathematical problems;
3. be able to formalize problems in economics in mathematical terms so as to assess the validity of proposed economic solutions;
4. be able to interpret the mathematical solutions of formalized economic problems and communicate them in a precise but understandable way to economists;
5. have acquired the capability to expand his/her capacity to learn further topics and concepts by autonomous studying of pertinent material.

Course content

CONTENT OF PRE-SESSION COURSE (12 hours, taught by prof. Michele Longo)

Sets, functions and correspondences

The set $\mathbb{R}^n$

Functions of one real variable

CONTENT OF MAIN COURSE (60 hours)

Linear Algebra

Vector spaces. Subspaces, spanning set, basis, dimension. Matrix, minor, determinant, adjoint matrix, rank. Linear mapping, kernel, affine subspaces, hyperplanes. Linear systems, Fundamental Theorem of Linear Algebra. Eigenvalues and Eigenvectors, diagonalization of matrices, quadratic forms.

Functions of several variables

Functions in $\mathbb{R}^n$. Continuity. Partial derivative. Gradient. Jacobian matrix. Chain rule. Differential. Higher-order derivatives. Taylor approximation. Convexity, concavity and quasi-concavity.

Implicit Functions

Implicit Function Theorem. Derivative of the implicit function. Graph of the implicit function, level curves and their slopes. Relationship of gradient and level curve. Application: Comparative statics.

Optimization

Unconstrained optimization. Constrained optimization with inequality constraints (Kuhn-Tucker method). Constrained optimization with equality constraints (Lagrange method). Economic interpretation of the Lagrange multiplier: shadow price.

Elements of Integral Calculus

Antiderivatives, indefinite integral. Integration by parts and by substitution. Area and definite integral. Fundamental Theorem of Integral Calculus. Infinite intervals of integration.

Dynamic Analysis

Difference equations. Differential equations. Optimal control theory format. Hamiltonian conditions.



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Transversality condition. Diagrammatic analysis.

Reading list

C.P. SIMON-L. BLUME, Mathematics for Economists, Norton, New York/London, 1994.

P.J. LAMBERT, Advanced Mathematics for Economists, Blackwell, 1985 (ch. 7, for Dynamic Analysis only).

Lecture slides will be available on Blackboard.

Teaching method

Lectures plus exercise group meetings.

Assessment method and criteria

Students will be evaluated on the basis of one written final exam.

For the exam the complete program is relevant.

The questions aim at testing the understanding of the fundamental theoretical issues, the extent of the candidate's knowledge and his/her ability to apply the theoretical understanding to practical problem solving.

To pass the exam the student must obtain at least 18 out of 32 points. Who achieves more than 30 points obtains as mark 30 with distinction (30 e lode).

The type of questions will be mostly similar to the exercises discussed in the exercise group meetings, but to give the possibility for outstanding students to show their excellence (to receive distinction), here and there a more sophisticated issue will be included.

Notes and prerequisites

Although the material treated in each lecture will be available on Blackboard by means of scans of what will be written during the lecture, it is essential that the course, due to its sequential nature and the additional verbal explanations given, be attended with utmost regularity.

As a prerequisite for a fruitful participation the student should have attended a basic mathematics course as is taught in any undergraduate program of social sciences.